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INSTRUCTION MANUAL

FOR

MOSS INERT GAS SYSTEM

Moss Order no. should always be referred to when ordering Spare Parts, Guarantee- and service questions

TYPE:	**MOSS FLUE GAS SYSTEM**
CAPACITY:	**9.400 m3/h**
TYPE:	**TOPPING UP INERT GAS GENERATOR**
CAPACITY:	**500 m3/h**
HULL NO:	**8239**
MOSS ORDER NO:	**130959**
SERIAL NO:	**6294**
BUILDING YEAR:	**2007**

Client / Client ref: **DUNQUAT SHIPYARD** **105K AFRAMAX FOR VINASHIN**	Project no.: **P-4398**	Serial no.: **6294**
Document title: **INSTRUCTION MANUAL FOR MOSS FLUE GAS SYSTEM/T.U.G**	Document no.: **130959InstructionManual**	

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1. GENERAL

1.1 General

The main reason for the installation of an Inert Gas System on board a tank ship is to minimize the danger of fire or explosion in cargo tanks.

This danger always exists, due to the fact that all three elements needed to start a fire or explosion, will be present.

These three elements are:

1. A combustible element, fuel, represented by hydrocarbon vapors from the cargo.
2. Energy to start the combustion, represented by sparks from various sources.
3. Oxygen to support the combustion, represented by the oxygen in the air, which contains roughly 21% oxygen and 79% nitrogen.

To set off a fire or explosion, all three elements must be present simultaneously.

If any of the three elements can be eliminated, the danger of explosion is also eliminated, and this is the philosophy behind the Inert Gas System.

When looking for the simplest element to remove one will find that:

1. The fuel part can never be eliminated, due to the nature of the cargo, which itself is highly flammable.

   The cargo will always evaporate explosive hydrocarbon vapors, which will fill any void spaces in the tanks and mix with air, entering the tanks through open hatches, etc.

   On ballast voyages the empty tanks are also filled with a mixture of air, drawn in when unloading and vapor from the cargo remain in the tank.

2. The energy spark to set off an explosion is also very difficult to eliminate completely.

   Exhaustive studies have been made by maritime bodies worldwide. No exact conclusion has been drawn, but it is a recognized fact that the most dangerous source of ignition is that of static electricity, which may be created in various ways inside the tank.

   The nature of this static, electricity is such that it is difficult to recognize, and therefore almost impossible to eliminate.

3. The only element left is the oxygen to support combustion. This is always present as 21% of the earth's atmosphere.

   However, the percentage of oxygen inside the cargo tank can be controlled by replacing the air with an inert gas, namely, a gas with an oxygen content low to form an explosive mixture regardless of the amount of petroleum gas in the atmosphere of the tank.

1.2 Explosive limits

The chemical composition of air is basically:

Oxygen O_2 = 21% volume

Nitrogen N_2 = 79% volume

A mixture of hydrocarbon gas and air has two limits of explosibility:

- the lower explosive limit (LEL) is 2% of gas - (98% of air).
- the upper explosive limit (UEL) is 10% of gas - (90% of air).

Within these two limits the mixture is flammable.

BELOW the lower explosive limit, the mixture is too lean to burn.

ABOVE the upper explosive limit, the mixture is too rich to burn.

- Hydrocarbon gas in a gaseous mixture containing oxygen will only burn if the content of hydrocarbon gas in the mixture lies between the upper and lower limits of flammability. These limits, which are respectively 10% and 2% in air, vary according to the oxygen content of the mixture. The gaps between them narrow progressively as the oxygen content diminishes (see diagram M4815-001std)
- If the oxygen content of the gaseous mixture is BELOW 11%, the hydrocarbon gas contained in the mixture CAN NOT BURN WHATEVER ITS CONCENTRATION MAY BE. An atmosphere containing less than 11% of oxygen is considered to be THEORETICALLY INERT.

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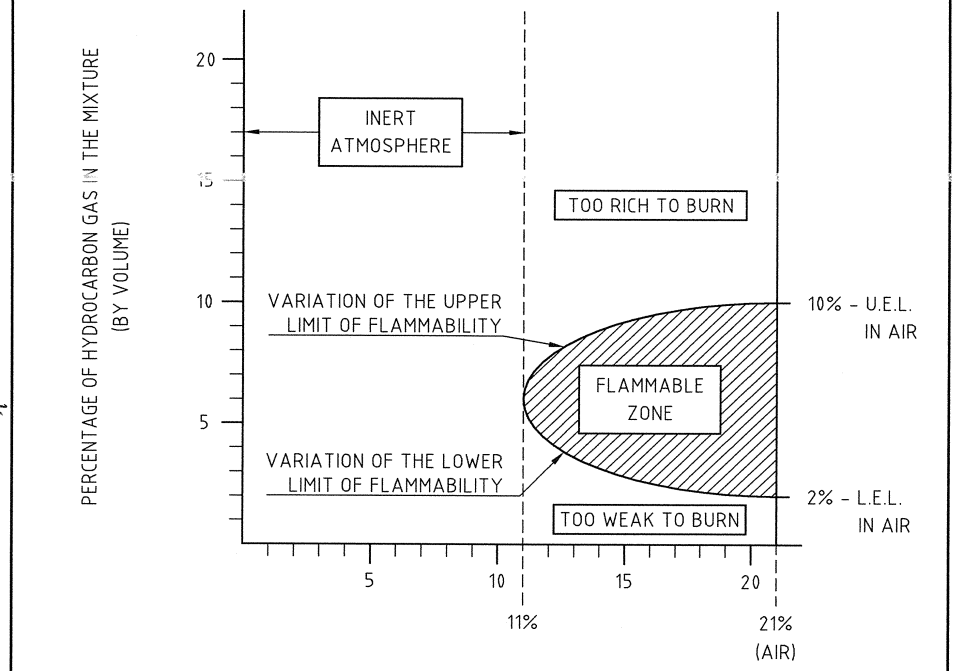

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1.3 Inert Gas System

The method of protecting an oil tanker by means of inert gas consists in completely isolating the ship's tanks from atmosphere. This is achieved by maintaining a slight overpressure in the tanks at all time, and leaving only the tank breathing valves free to open.

Whilst discharging cargo (or ballast from cargo tanks), the liquid pumped out of the tanks is replaced by inert gas. At all times the pressure of the inert gas in the tanks is maintained slightly above atmosphere pressure.

From one dry-docking to the next, the ship is constantly protected by inert gas. The only exception being in the case of work having to be done inside one of the tanks, or inerting from gas free condition which requires the inert gas to be replaced by air. During air venting the tank atmosphere must never reach in flammable zone (see diagram page 1.3).

This procedure means a greater all-round safety in the operation of the ship, not only during tank cleaning, loading and discharging operations, but also during voyages.

The inert gas used on this ship can be produced in the following ways:

1. As a conventional Flue Gas Plant - by cooling and cleaning gas from boiler uptakes.
2. As a conventional independent Generator System - by burning fuel oil at a very low excess of air, to be used during voyages to obtain overpressure.

The gas consisting mainly of Nitrogen N_2 and Carbon Dioxide CO_2, is cooled and cleaned of soot and SO_2 by Seawater in a scrubber unit, and subsequently distributed to the tanks through a deck piping system by means of centrifugal blowers.

The full capacity running as flue gas plant requires a certain minimum fuel oil flow to the boiler.

The diagram can decide this minimum oil consumption on the following page.

WARNING
WHEN RUNNING AS FLUE GAS PLANT WITH THE BOILER ON TOO LOW LOAD, THE FLUE GAS BLOWER MAY SUCK FRESH AIR DOWN THE BOILER FUNNEL.

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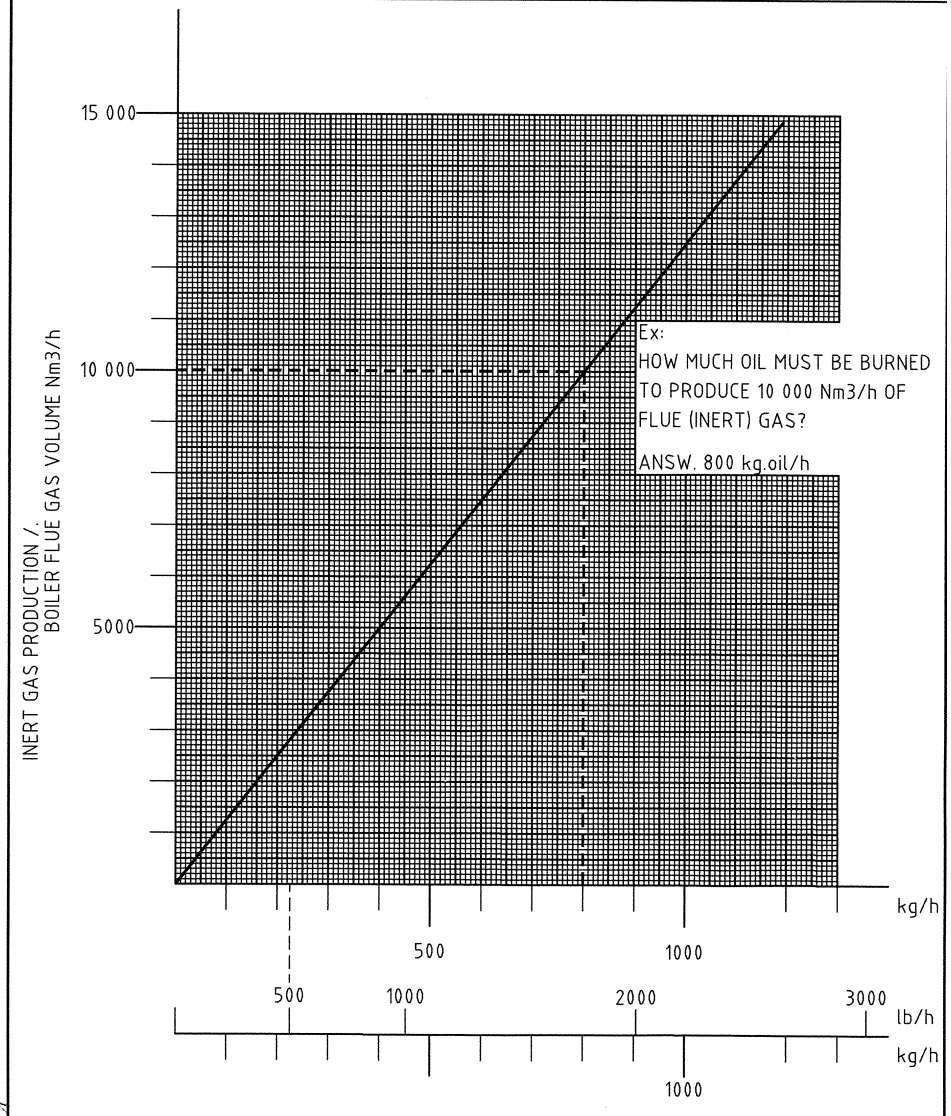

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Hamworthy Moss AS	Title: RELATION BETWEEN BOILER FUEL OIL CONSUMPTION, AND AMOUNT OF FLUE GAS PRODUCED (BASED ON BUNKER C OIL, AND FLUE GAS O2 CONTENT OF 3% O2)						M1296-007std		Rev. 00
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1.4 Capacity and Rate of Supply of Inert Gas

The most critical demand for inert gas is during cargo discharge, when the supply at least must be equal to the cargo discharge rate. Centrifugal cargo pumps have a rated capacity against a nominal head, but on some occasions it is possible to exceed the rated capacity discharging against a lower head.

To cater for such variations in discharge rate, the inert gas system capacity has been sized on the nominal pumping rate multiplied by at least 1.25.

IF THE CARGO DISCHARGE CAPACITY EVER EXCEEDS MAX. INERT GAS CAPACITY, THE DISCHARGE RATE SHOULD BE REDUCED IN ORDER TO MAINTAIN A POSITIVE INERT GAS PRESSURE IN THE CARGO TANKS.

1.5 Safe Oxygen Levels

During inert gas plant operations, it is of utmost importance to keep the oxygen level below 5 % by volume, in order to have a good safety margin.

Oxygen levels:

11% OXYGEN:	MINIMUM OXYGEN LEVEL necessary to support combustion/explosion. This level, however, is not considered safe, since there is no margin left for measurement errors.
8% OXYGEN:	MAXIMUM OXYGEN LEVEL allowed during discharge operations. However, necessary steps must be taken to ensure oxygen level below 8%.
5% OXYGEN:	SATISFACTORY OXYGEN LEVEL. This is the normal maximum level that shall be maintained under all operating conditions.
LESS THAN 5% OXYGEN:	BEST OXYGEN LEVEL for good operation vessel. The I.G.S. operation in the following sections refers to this level.

1.6 Health Hazards with Inert Gas

NOTE!
ALL PERSONNEL MUST BE MADE AWARE OF THE HAZARDS AND PRECAUTIONS LISTED IN THE FOLLOWING PARAGRAPHS.

1.6.1 Oxygen deficiency

All inerted areas are areas with an atmosphere containing very little oxygen.

Exposure to an atmosphere containing less than 5% oxygen results in IMMEDIATE UNCONSCIOUSNESS. If resuscitation is delayed for more than approximately four minutes, irreversible brain damage will occur. Further delay will kill!

Even if the oxygen deficiency is not sufficient to cause unconsciousness, the mind is liable to become apathetic and complacent, and even if these symptoms are noticed and escape attempted, physical exertion will aggravate the weakness of both mind and body.

Therefore, an oxygen deficiency is much more serious than exposure to hydrocarbon vapours. For this reason a full scale reading (21%) on a portable oxygen analyzer should be obtained throughout the tanks before entry is allowed. Additionally, precautions are necessary before and during tank entry, to ensure that inert gas does not enter a gas free tank via I.G. main, cargo pipelines or possible bulkhead cracks.

NOTE!
AN OXYGEN DEFICIENT ATMOSPHERE MAY NOT ONLY BE PRESENT WITHIN A CARGO TANK, BUT ALSO IN ADJACENT CARGO PUMP ROOMS, PERMANENT BALLAST TANKS, VOID SPACES, AT GAS EXITS AND WITHIN INERT GAS PLANTS TO BE OVERHAULED.

1.6.2 Toxicity of Hydrocarbon Vapours

Inert gas has no effect on the toxic nature of hydrocarbon gases, and the problem is no different from the toxicity of hydrocarbon vapours in ships without an I.G. system. Because of possible gas pockets, regeneration, etc. gas freeing must continue until the entire compartment shows a zero reading with a reliable combustible gas indicator, or a 1% lower flammable limit reading, should the instrument have a sensivity scale on which a zero reading is impractical.

1.6.3 Inert Gas Toxicity

Any combustion of oil may produce limited amounts of toxic gases such as sulphur dioxide (SO_2), Carbon monoxide (CO) and oxides of nitrogen (NO_x).

Measurement is the only way to detect the presence of these toxic gases. However, if the hydrocarbon gas content of an inerted tank exceeds approximately 2% by volume before beginning of gas freeing, dilution of toxic components of inert gas as gas freeing progresses can be correlated with the readings of an approved combustible gas indicator. If ventilation of the compartment results in a lower flammable limit reading of 1% or less in conjunction with an oxygen reading of 21% by volume, toxic gases will have been diluted to a concentration, which will be safe to enter, and disregarding the initial hydrocarbon gas content, continue ventilating a steady oxygen reading of 21% by volume is reached.

1.6.4 Tank Pressure

Personnel should be advised of the practical hazards when an inerted cargo tank is maintained at a positive pressure. The pressure must be sufficient relieved before any tank lids, ullage plugs or tank washing openings.

1.6.5 Electrostatic Hazards

An electrostatic charge can occur in the small particular matter carried in inert gas. Although the charge is normally of a low level, much higher levels have been observed with water mists created by tank washing.

Cargo tanks are usually in an inerted condition and electrostatic ignition is not a consideration unless the oxygen content of the tank atmosphere is increased by the entrance of air, or unless it is necessary to inert a tank already containing a flammable atmosphere.

1.6.6 Repair of Inert Gas Generating Plant

Inert gas is asphyxiating and extreme caution must be exercised at all times when working on the plant. Being in fresh air during the work is not a safety guarantee, since inert gas possibly leaking from the plant can still cause unconsciousness very quickly. Therefore, the plant should be completely gas freed before any equipment is opened up.

An external examination of any unit, such as the inert gas scrubber, must not be performed without following the standard recommendations for entering enclosed spaces. Blind flanges should be fitted where applicable or the plant should be completely isolated.

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2. TECHNICAL DATA

2.1 Performance Flue Gas System

Nominal capacity: 9.400 m³/h

Basic Flue Gas Composition

O_2-content: 5% by volume

CO_2-content: Approx. 13% by volume

SO_2-content: Approx. 3000 ppm.

N_2-content: Balance

Inert Gas Composition

Based on the above flue gas mode the inert gas analyses will be:

O_2-content: No change

CO_2-content: No change

SO_2-content: Less than 100 ppm.

N_2-content: Balance

Efficiency of sooth-extraction equal to or higher than 99% of particles above 1 microne.

2.2 Performance Generator System

Nominal capacity: 500 m³/h

Delilvery press. generator outlet: Approx. 0,12 bar (g) at 100% capacity

Normal oxygen content: 1-5% by volume

Oxygen content adjustable down to: Approx. 1,0% by volume

Gas composition by volume at O_2 = 3%

(also for combined operation)

CO: Max. 100 ppm

NO_X: Max. 150 ppm.

SO_2:	Max. 1 ppm.
CO_2:	Approx. 14%
N_2 + Ar:	Balance

2.3 Common Data

Gas temperature at cooling tower, outlet:	Max. 5°C above cooling water temp.
Carry over of water droplets:	Less than 1 g/kg dry gas

El. power 3 phase, 440 V, 60 Hz

El. motor, 100% blower, net:	Approx. 50 kW
El. motor, f.o. pump, net:	Approx. 0,5 kW
El. motor, 100% blower, net (I.G.G.):	Approx. 6,4 kW

El. power single phase, 220 V, 60 Hz

Control system:	Approx. 1,5 kW

Instrument air at 6-10 bar g

Control system (in balance):	Approx. 4 Nm³/h
Ignition burner:	Approx. 0,3-0,4 Nm³/h

Air for ignition burner can be taken from other sources than for instrument air reservoir.

Normal working air at 5-10 bar g will be acceptable.

2.4 Utilities

Fuel oil

(500 Nm³/h Inert Gas at 3% by vol. O_2 by consumption of ambient air)

Capacity:	Approx. 40 kg/h
Type of fuel oil:	Marine distillate fuels, Class DMA, DMB or DMC ISO 8217:1996 (E)

Seawater (raw)

Capacity (cooling tower):	Approx. 150 m³/h (filtered to 3 mm) for Flue Gas Approx. 35 m³/h for Topping Up
Pressure (cooling tower):	Approx. 2 bar g at plant inlet for Flue Gas and Topping Up
Capacity (Deck Water Seal):	Approx. 3 m³/h
Pressure (Deck Water Seal):	Approx. 1 bar g at D.W.S. inlet

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3. DESCRIPTION OF EACH UNIT

Inert Gas Generator for Topping up:

3.1 The Oil Burner

is of the mechanical high pressure atomizing type. Oil gun and fuel oil nozzle are of the simplex type.

This I.G.G. is built for burning Light Marine Diesel/Gas oil.

The oil is directed to the orifice through some tangentially slots, thus the oil gets a rotating motion and the oil to the burner leaves the nozzles as a thin rotating membrane which is atomized just after the nozzle. The atomized oil forms a cone, in which the top angle depends on the nozzle type and oil pressure. When oil pressure and thereby oil quantity is increased, the rotating velocity increases, and the atomizing cone increases (higher oil pressure = higher oil quantity = higher rotating velocity = greater atomizing cone).

The oil gun is adjustable in axial direction to find the best position for the oil nozzle.

A stuffing box around the oil gun with asbestos gasket avoid gas leakage.

The combustion air is supplied tangentially to the burner. This means that the air, already when entering the outer gas chamber, is brought in rotation.

The rotation is strengthened at the same time as the velocity increases through a number of vanes on the way via an exactly circular distribution opening (burner neck) into the combustion chamber, where combustion air and fuel oil are mixed. A small part of air passes through a tube around the oil gun as "primary air".

The "primary air" blowing along the oil gun prevents settling of uncombustioned oil particles on the fuel oil nozzle. For complete combustion it is necessary to mix the atomized fuel oil and combustion air as good as possible. This is obtained by high relative velocity between oil and gas. The axial air velocity at the oil nozzle must, however, not be higher than the rate of combustion, as this would mean that the flame would be blown away from the nozzle. Therefore, as mentioned before, a high velocity is obtained even at a low axial velocity at the center of the burner. For further increase of the relative velocity between oil and air they are given oppositely directed rotation.

Although the combustion chamber is made in one piece, it may be considered containing three parts. Each of these parts, the upper, which is cylindrical, and the lower, which also has the shape of a cut cone, are made as water jackets to avoid too high terminal stresses.

In the front of the burner, there are openings for oil gun, ignition burner and view ports with glasses and gate valves for flame control and inspection.

3.1.1 The Ignition Burner (Fig. 3-3)

Which is welded into an opening in front plate of the oil burner, consists mainly of a cylindrical combustion chamber with internal linings, 1.0 U.S. gal/h fuel oil nozzle (Item No. 88) and an ignition glow plug (Item No. 89). Combustion air, which flows outside the internal lining for cooling, is supplied from the 100 psi working air system, and in the line a solenoid valve (Item No. 152) and a control valve (Item No. 62) is mounted.

The top plate to which the oil nozzle and glow plug are fixed, is removable by opening a cap nut. In the oil supply line one solenoid operated shut-off valve (item No. 158) is mounted.

The 10-15 cm long pilot flame is coming out through the tube, which is connecting the ignition burner to the front plate of the main burner.

Time from ignition glow plug is activated and to the main burner is supplied with fuel oil is approximately 35 seconds.

3.1.2 The Cooling Tower

The gas developed by the burner with forced air from the blower, will be pre-cooled, with injected Seawater into the central tube, when passing through the combustion chamber and down below the wet filter.

When the gas leaves the central tube in the bottom part of the scrubber and turns 180°C, it flows upwards through a stainless steel wet filter (Item No. 130) fitted in the lower part of the scrubber.

After passing the wet filter, the gas is forced further upwards through a spray of Seawater coming from a set full cone spray nozzles, (Item No. 117), fitted in a Seawater distributing ring in the upper half of the scrubber.

The purpose of the wet filter is to obtain a good contact between the hot gas and the cooling water.

After having been effectively cooled and cleaned, the gas finally passes through a stainless steel demister (Item No. 131) before it leaves the scrubber through the outlet duct on the upper part of the tower.

The demister is abundantly dimensioned to effectively prevent any water droplets to be carried away from the scrubber.

Access openings are provided in the tower, just above both the wet filter and the demister, for easy inspection, maintenance and possible cleaning or changing Seawater nozzles.

3.1.3 Fuel Oil System

consists of:

Oil pump with electric motor (Item Nos. 82, 83), duplex oil filter with double three-way valves (Item No. 81), flow meter (Item No. 202) and oil pipings. Connection to oil gun is made by a flexible hose (Item No. 84). The oil supply to the main burner pipeline is fitted with one solenoid valve each (Item Nos. 153, 156). The oil pump is equipped with a pressure regulating valve, and is directly connected to the electric motor via a flexible coupling.

During stop of plant solenoid valve (Item No. 157) is energized for a few seconds in order to air flush the oil gun, except in air venting mode, "EMERG. STOP" or "FLAME FAILURE" alarm.

3.1.4 The Combustion Air System

consists of the following parts:

Blower with electric motor, silencers, air filter and expansion joint. The blower is driven by an electric motor.

Blower and electric motor is mounted on a common base plate, which is laid on resilient mountings.

To avoid vibrations in the pipes, expansion joint is mounted downstream outlet silencer.

The air quantity to the burner is adjusted with the valve Item No. 12.

3.1.5 Flow Control Valve

One butterfly control valve, Item No. 6, operated by pneumatic actuator with positioner will maintain the flow through the system controlled by the PLC. To protect blower motor the valve is forced in open position during blower start up period.

3.1.6 The Cooling Water System

For cooling and cleaning of the inert gas Seawater is used. The main part in the cooling tower and the rest is used for cooling of the burner and pre-cooling of the gas in the central tube.

A control valve (Item No. 50) is mounted in the s.w. line to cooling jacket - adjusted and locked.

NOTE!
THIS VALVE SHOULD ONLY BE OPERATED BY QUALIFIED PERSONNEL.

3.1.7 The Drain System

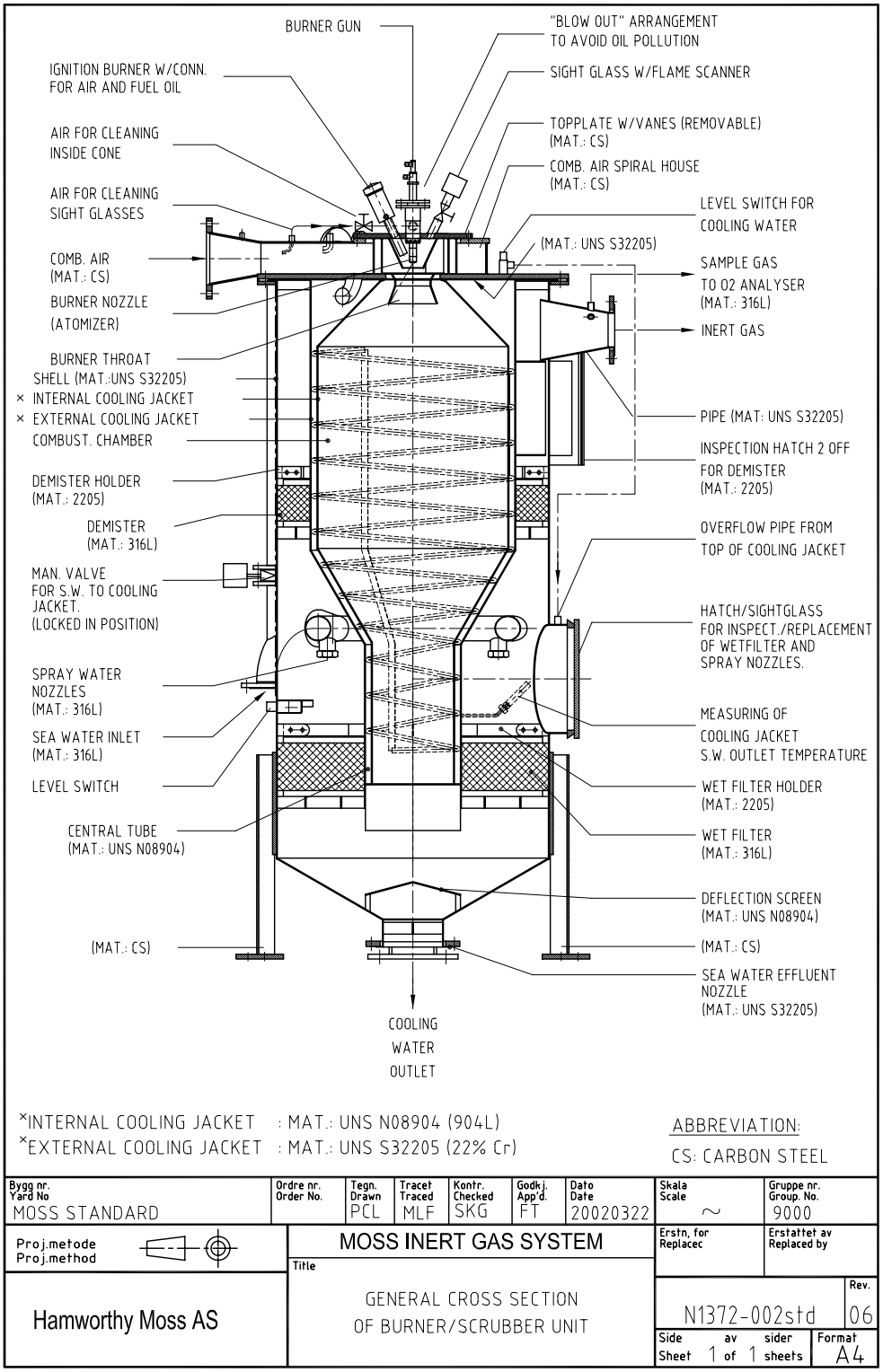
permits the Seawater effluent from the cooling tower to be drained without letting the inert gas out.

This is obtained by fitting an overboard shut-off valve (Item No. 14) at a level of minimum 3,0 m below the light ship water line.

3.1.8 Oxygen Analyser (stationary) (Item No. 232)

One stationary oxygen analyser is installed, sampling the inert gas after the burner.

The analyser is described in a separate manual - Chapter 11.



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Hamworthy Moss AS	MOSS INERT GAS SYSTEM GENERAL CROSS SECTION OF BURNER/SCRUBBER UNIT	N1372-002std	Rev. 06
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REV. 03) 20030228/FT UPDATED REV. 04) 20040127/ PCL. WET FILTER HOLDER: 2205 REV.05) 20060530/PCL SPRAY WATER NOZZLES AISI 316L

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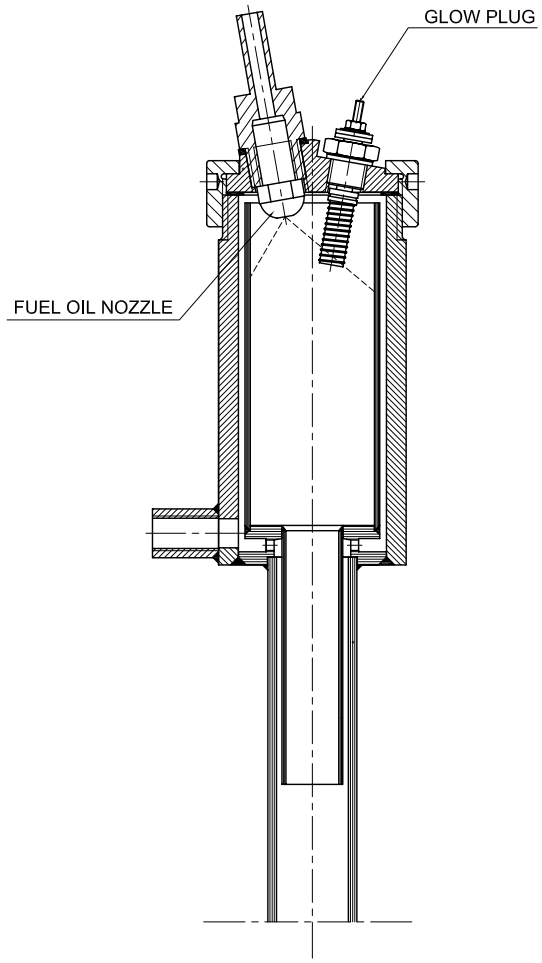

FIG. 3-3

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3.2 Scrubber Tower (Item No. 253)

The gas from the boiler uptake valves enters the inlet duct on top of the scrubber tower. The gas is led through a central tube down to the lower part of the scrubber where it turns and run on the outside of the central tube back up towards the scrubber tower outlet.

The central tube is manufactured in AVESTA 904 L and is designed as a pre-washer, with a full cone Seawater nozzle (Item No. 116) installed. Additionally, the part of the central inlet tube where the pre-wash nozzle is mounted, is formed as a venturi to ensure an efficient cleaning of the gas in this first stage. Due to partial evaporation where the Seawater spray meets the hot flue gas, a considerable cooling effect is achieved.

The gas leaves the central tube in the bottom part of the scrubber, turns 180°, to run upward through polypropylene wet filter (Item No. 130) in the lower part of the scrubber.

After the wet filter, the gas is forced further upward through a fine spray of Seawater droplets coming from a set of full cone spray nozzles, (Item No. 117), fitted in a Seawater distributing ring in the upper half of the scrubber tower.

After having been effectively cooled and cleaned by the Seawater sprays, the gas finally passes through a polypropylene demister (Item No.131) before it leaves the scrubber tower through the outlet duct on the upper part of the scrubber.

The demister is abundantly dimensioned to effectively prevent any water droplets to be carried away from the scrubber.

The scrubber tower is manufactured in mild steel, internally coated with a 800 - 1000 microns layer of G.R.P. Below the wet filter, an effluent water outlet is provided, which is led via a drain line down to a none return valve and an overboard shut off valve (Item No. 14), fitted well below the light ship water line.

Access openings are provided in the tower, just above both the wet filter and the demister, for easy inspection, maintenance and possible cleaning or changing Seawater nozzles.

3.2.1 Inert Gas Blowers (Item No.100 & 101 with Motors Item No. 103, 104)

The plant is equipped with two (2) centrifugal types, single stage blowers and can each supply 50% of plant capacity.

The blowers are the only flue gas transporters in the system.

They draw the gas from the boiler uptake, through the scrubber, and deliver to the deck distributing pipe system with sufficient overpressure to ensure a high velocity gas jet is forced into the cargo tanks.

The blowers characteristics are such that they can not generate sufficient head to over-pressurize the cargo tanks and cause unnecessary lifting of relief valves within the system.

The blowers are of "A/S Flebu" make, type BK 25 – 1.

The blower casing are made of 6 mm steel plate, grit blasted and internally protected by a 800 - 1000 microns layer of G.R.P.

Blower impellers are made of acid resistant steel AISI 316L with impeller shaft in SIS 2244 material. The blower casing is provided with water spray nozzles and drains.

The blower and motor are mounted on common base plate resting on resilient mountings.

3.2.2 Boiler Uptake Valves

At the boiler uptake butterfly valves (Item Nos. 24-1, 24-2 and 26) of Valvulas-Jola make are mounted with a maximum working temperature 450°C.

Two valves mounted close to the boiler uptake duct and one valve downstream sealing air pipeline connection.

At uptake valve soot blowing air/steam nozzles for valve cleaning shall be mounted by yard.

The valves are pneumatically operated by double acting cylinders controlled by solenoid valves.

3.2.3 Expansion bellows (Item Nos. 110, 111 and 112)

Close to the boiler uptake valves, expansion bellows are installed.

3.2.4 Sealing Air Valve

To prevent deposits/leakage gas in the uptake system, when the plant is shut down, a sealing air supply line is run from the discharge side of the boiler forced draft fans, to the pipe line between the boiler uptake valves.

A shut off butterfly valve, (Item No. 4) is installed in this sealing airline, operated by a double acting pneumatic actuator, controlled by a solenoid valve.

When the boiler uptake valves are closed, the sealing air valve is open and vice versa.

3.2.5 Blower Inlet Valves

Two butterfly valves (Item Nos. 10 and 11), one on inlet side of each blower is installed. The valves are manually operated.

3.2.6 Flow Control Valve

Two butterfly control valves, Item No. 7 and 8 are operated by pneumatic actuator with positioner, will maintain the flow through the system controlled by the PLC. To protect blower motor the valves are forced in closed position during blower start up period.

For gas freeing of cargo tanks, a fresh air intake is arranged at scrubber inlet. The fresh air intake is arranged with hinged hatch with limit switch, Item No. 260.

3.2.7 Pressure controlled blow off valve

One butterfly valve, Item No. 2, for gas venting and deck main pressure. The valve is operated by pneumatic actuator with positioner automatically in accordance with the value set in the PLC. The pressure set point is made remotely by operation of push buttons in the main control panel.

The valve is also operated by the oxygen analyzer, i.e. leading gas to atmosphere, when gas analysis is not within set limits.

3.2.8 I.G. main valve

One butterfly shut off valve, Item No. 1. The valve is operated by pneumatic actuator.

The valve is operated from the main control panel and will automatically open when the gas analysis meets the requirements, otherwise closed.

During start-up and shut-down the valve is automatically forced to closed position.

Downstream I.G. main control valve a vent valve, Item 47, is fitted on I.G. main line. This valve is open when plant is shut down for the purpose to vent the I.G. line.

3.2.9 Flexible connections (Item No. 107 and 108).

Blower inlet and outlets are equipped with flexible connections.

Flue Gas Plant:

3.3 Oxygen Analyser (stationary) (Item No. 204)

One stationary oxygen analyser is installed, sampling the inert gas after the blowers.

The analyser is described in separate manual - Chapter 11.

3.3.1 Deck Water Seal (Item No. 250)

The deck water seal is of displacement type, the water inside the seal is displaced into a reservoir during operation and will immediately fall back and close the seal, in case of loss of the positive gas flow.

The gas inlet center tube is leakage secured by an internal double tube. The small tube w/goose neck on water seal top indicates if any leakage.

The water seal has a built-in retractable steam heating coil.

The water seal is equipped with manholes and inspection glass for water level control, level switch, Item No. 194 for low-level alarm.

The mesh demister in the upper part of the water seal is effectively preventing carry over of water droplets to/or less than 1 g/kg dry gas under all flow conditions.

Any back pressure from the cargo tank area will induce an overpressure in the reservoir chamber above the water level, and force water into the center tube.

Here the water level in the center tube will rise, and thus preventing gas from leaking past the seal.

When the plant is operating, and inert gas is admitted to the deck distribution system, the pressure from the blowers will empty the center tube into the reservoir, letting the gas flow freely through the top part of the reservoir chamber. Here gas is forced through a demister, where possible water droplets are separated from the gas and led back to the water reservoir.

The deck water seal shell is manufactured in mild steel, internally lined with Glass Reinforced Polyester (GRP).

Center tube is manufactured in mild steel/stainless steel.

3.3.2 Deck Water Seal Supply

Two Deck Water Seal pumps, Item No. 125, are installed.

One of the pumps must always supply the deck seal with water.

3.3.3 Scrubber Tower: Seawater Supply

The scrubber Seawater pump, Item No. 128, is installed in the engine room. The pump is directly connected to el. motor Item 129.

A main shut off valve (Item No. 5) is mounted on inlet nozzle to scrubber. To avoid water hammering in the S.W. system, the valve will open 10 secs. prior to start of s.w. pump.

NOTE!
WHEN S.W. AUX. SUPPLY IS SELECTED, VALVE (ITEM NO. 19) MUST BE OPENED CAREFULLY TO AVOID WATER HAMMERING.

3.3.4 Non return valve in main deck line (Item No. 64)

and for ballast system (Item No. 62).

The purpose of this non-return valve is to prevent backflow of cargo gases from the tanks to the I.G. production plant.

3.3.5 Deck isolating valve (Item No. 13)

This valve isolates the I.G. deck main when the I.G. plant is shut down.

3.3.6 P/V breaker (Item No. 252)

The P/V breaker is located on the main deck, connected to the deck main I.G. line. It serves the purpose of preventing the cargo tanks from being subjected to excessive pressure or vacuum should all other safety precautions fail.

The P/V breaker works as follows:

In the case of excess pressure, the liquid in the seal is forced out on deck, and the pressurized gas escapes to atmosphere.

In case of vacuum, the liquid is sucked into the deck I.G. line, and air from outside is drawn into the tanks.

In both cases the safety of the ship is assured.

(The noise of gas or air going through the seal acts as an audible alarm signal).

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4. INSTRUMENTATION AND CONTROL SYSTEM

4.1 Indicating/Recording Instruments

Item Nos. refer to P&I Diagram.

4.1.1 Temperature Indicators (TI)

Temperature Seawater main inlet flue gas scrubber (Item No. 175).

Temperature Seawater main inlet topping up generator (Item No. 175).

Temperature exhaust gas (Item No. 176).

Temperature Gas/air outlet blowers (item No. 177)

Temperature Seawater outlet cooling jacket topping up generator (Item No. 178).

Temperature inert gas outlet flue gas scrubber (Item No. 179).

Temperature inert gas outlet topping up generator (Item No. 179).

Temperature inert gas outlet blowers (Item No. 188).

4.1.2 Pressure indicators (PI)

Instrument air pressure - common (Item No. 160).

Exhaust gas pressure (Item No. 161).

Combustion air pressure - topping up generator (Item No. 161).

Seawater pressure to cooling jacket - topping up generator (Item No. 162).

Inert gas outlet pressure blowers (Item No. 163).

Seawater pressure to water nozzles - topping up generator (Item No. 164).

Seawater pressure to water nozzles flue gas (Item No. 164).

Oil pressure to main burner - topping up generator (Item No. 165).

Inert gas pressure outlet cooling tower topping up generator (Item No. 220).

Inert gas pressure outlet flue gas scrubber (Item No. 167).

I.G. deck main pressure (Item No. 182).

Seawater pressure to D.W.S. (Item No. 169).

4.1.3 Flow Meter (FI)

Sample gas to analyse transmitter (Item No. 204).

4.1.4 Analyse Indicators (AI)

O_2-content in inert gas (Item No. 204).

4.1.5 Recording/Indicating Instruments (PIR/AIR)

2 - pen recorder/indicator (item No. 217) for O_2-content in inert gas and I.G. deck pressure.

4.1.6 Transmitters

Pressure transmitters - I.G. in I.G. deck main line (Item No. PT-182).

Temperature transmitter - I.G. downstream flue gas blowers and topping up generator (Item No. TT-188).

Pressure transmitter outlet scrubber - topping up generator (Item No. PT-220).

4.2 Safety Interlocks

4.2.1 Blower current switch

Low amp. blower 1 or 2 failure, alarm and stop of plant (Item Nos. 180 and 181).

4.2.2 Temperature Switch

Inert gas temperature high, alarm and stop of plant (Item No. 188).

Flue gas temperature high, in flue gas scrubber, alarm and stop of plant (Item No. 192).

4.2.3 Pressure Switches

High inert gas deck main pressure, alarm and vent to atmosphere (Item No. 182).

High/Low combustion air pressure - topping up generator, alarm and stop of plant (Item No. 180).

Very low inert gas deck main pressure alarm (item No. 182).

Low instrument air pressure - common, alarm and stop of plant (Item No. 183).

Low Seawater pressure to cooling tower topping up generator, alarm and stop of plant (Item No. 184).

Low fuel oil pressure to burner topping up generator, alarm and stop of plant (Item No. 185).

Low Seawater pressure to flue gas scrubber, alarm and stop of plant (Item No. 184).

Low I.G. deck main pressure, alarm (Item No. 187).

Low Seawater pressure to D.W.S., alarm (Item No. 189).

4.2.4 Level Switches

Low Seawater cooling level in burner jacket, alarm and stop of plant (Item No. 191).

High Seawater level in flue gas scrubber, alarm and stop of plant (Item No. 193).

High Seawater level in cooling tower topping up generator, alarm and stop of plant (Item No. 193).

Low Seawater level in deck water seal reservoir, alarm (Item No. 194).

4.2.5 The Ignition Transformer (Item No. 209)

is a glow plug transformer, which is connected to 220V and gives approx. 13V to the glow plug fitted on the ignition burner.

4.2.6 The Flame Control

is registering the burner flame, and on the contrary case take care of stopping the plant and that alarm is given.

The flame control consists mainly of a scanner unit with photoelectric cell and an amplifier, which amplifies the weak signals from the photo cell to impulses that are able to operate a flame relay. See separate instruction for adjustment of the amplifier, Chapter 11.

4.2.7 The Programming Controller

The programming controller takes care of all control and regulation functions.

4.2.8 Interlock between boiler sootblowers and Flue Gas Plant

When the inert gas plant is started (i.e. water circ. running) an interlock signal will prevent the boiler soot blowers from being started.

4.3 Instrument and Control Panels

4.3.1 General

In the following are listed all instruments and control panels within the system, with the main items and the function of same.

The operation and use of the panels during plant operation are covered in detail in following section 5.

4.3.2 Main Control panel – Cargo Control Room (Item No. 233)

The Main Control panel is located in Cargo Control Room, and the plant start up is initiated from this panel. The panel contains the programmable controller.

On the front of the panel, the I.G. plant is visualized on touch screen. The alarm handling system works as follows:

The control system is provided with N.C. alarm contacts, i.e. upon loss of electric power, the system will fail to safe. At normal running conditions the alarm-banner is dark and no flashing bell can be seen. Any alarm condition is indicated on the touch screen (on any page) by a flashing bell in the upper right hand corner of the screen and an audible alarm will be given by a horn.

The last occurred alarm is described in the alarm-banner, with a red text. By acknowledging the alarm, the audible alarm will stop. Acknowledging the alarm, on the touch screen, is done, by pressing the alarm banner. The text then turns from red to blue. After having reset the alarm, and in case the alarm cause is removed, the alarm description will disappear.

In case of more than one alarm having been activated, only the last registered alarm will be shown in the alarm-banner. In order to accept the other alarms, push the ALARM LIST button, and accept each alarm description separately.

By too high/low oxygen content, as well as most other alarm and shut down situations, the inert gas to atmosphere valve will open and the inert gas main valve will close.

4.3.3 Local Panel - Engine Room (Item No. 234)

This panel is locally mounted on the generator and contains touch keys for manual start of the Topping up Generator. On the front of the panel, the Topping up plant is visualized on a touch screen.

The panel contains touch keys for alarm accept and alarm reset.

The items mounted can be seen on the drawing for Local Panel Topping Up Generator.

4.3.4 Sub Panel - Wheel House (Item No. 239)and Sub Panel – Engine Control Room (Item No. 240)

On each panel the following are mounted:

Item No. 239:	**Item No. 240:**
Oxygen content indication	Oxygen content indication
Deck main pressure indication	Deck main pressure indication
	Inert gas temperature indication
Alarm buzzer	Alarm buzzer
Push buttons for lamp test and alarm accept	Push buttons for lamp test and alarm accept
Deck high pressure alarm	Deck high pressure alarm
Deck low pressure alarm	Deck low pressure alarm
O_2 content high/low alarm	O_2 content high/low alarm

The items mounted on the front can be seen on the drawing for Sub panel for Wheelhouse and Engine Control Room.

4.3.5 Oxygen analysing system

The oxygen analyser panel (Item No. 232) is located in the vicinity of the generator.

Variations in oxygen content is registered directly by the O_2-analyser (Item No. 728). The bubble glass (Item No. 331) cleans the inert gas and indicates flow.

Analyser sample flow is set by the flow control valve (Item No. 745).

The three-way valve (Item No. 358) selects between sample (instrument) air or N_2.

Sample gas is taken from generator outlet nozzles pressurized to the analyser.

Calibration with air (20,9%)

For further information, refer to Oxygen Analyser Instruction Manual, Section 11.

Adjustable O_2-Alarm

On the alarm page in the touch screen for the main control panel (Item No 233) it is possible to adjust the O_2-alarm set point. (HAC 204).

Min. setting is 1% and max. setting is 7%.

Press the touch key, a numeric pad pops up, set the alarm level and press enter.

4.3.6 The instrument air

Supply to the pneumatically operated valves and control devices shall have a pressure of 6-10 bar (g), and supplied dry and clean.

The pressure is reduced to max. 7 bar (g) by the reduction valve (Item No. 262).

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5. INSTRUCTIONS FOR PLANT START, OPERATION AND STOP

5.1 Short form, step by step, plant start and stop instructions

By activation of key HELP on the touch screen a page containing touch keys for operation procedures and trouble-shooting will show up.

5.1.1 Before start

1. The inert gas system shall be powered at all times. This because some alarm functions must be operative even if the plant is not running.
2. Check that there is no alarm condition.
3. Reset all alarms, if any, by pressing the keys ALARM ACCEPT and ALARM RESET.
4. Check the oxygen analyser for correct calibration.

5.1.2 Start - Flue Gas (only auto)

1. Carry out checks listed in section 5.1.1 “Before start”.
2. Select which Seawater system to be in operation by position of aux. Sea-water supply valve.
3. Select boiler uptake with touch key(s).
4. Select blower(s) with key SELECT BLOWER 1 or SELECT BLOWER 2.

   Valve inlet selected blower must be open, and hinged hatch for air inlet must be closed. Valve outlet scrubber must be in open position.

5. Clean uptake valve for soot with touch key SELECT VALVE CLEAN.
6. Press START FLUE GAS touch key.

   If flashing light, the plant is stand by waiting for start power available.

   By maloperation or alarm the lamp will remain unenergized.

   The start sequence is indicated with lamps on the mimic diagram on start page on the touch screen.

7. Adjust the selected capacity with HIC 7/8 SET POINT.
8. Check the temperatures and pressures.
9. Check and if necessary adjust the flow through the O_2 analyser's bubbler unit.
10. Check that O_2-content in the gas is below 5%.
11. The plant is now ready for production of inert gas to consumer. If SELECT DECK is activated, valve to deck will open.

12. The deck pressure can be controlled by operation of touch key HIC2 SET POINT in front of main control panel.

5.1.3 Gas freeing

The plant is prepared for purging the tanks with fresh air during gas freeing of the cargo tanks.

1. Select blower by operation of touch keys in front of main panel. Hinged hatch for air inlet must be in open position and valve outlet scrubber must be closed.
2. Press START AIR VENT touch key.

   By maloperation or alarm the lamp will remain unenergized.
3. The selected blower(s) will start automatically.
4. Wait 50 seconds for blower to obtain normal running condition.
5. Adjust the selected capacity with HIC 7/8 SET POINT.
6. The plant is now ready for production of air to deck. If touch key SELECT DECK is activated, valve to deck will open.
7. The deck pressure can be controlled by operation of the key HIC 2 SET POINT in front of main control panel.

5.1.4 Normal (auto) start - Inert Gas Generator

1. Carry our checks listed in section 5.1.1 "Before start".
2. Press START TG AUTO touch key.

   By maloperation or alarm the lamp will remain unenergized.
3. The start sequence is indicated with lamps on the mimic diagram. Check that all air is evacuated from cooling jacket outlet and sight glass before the LED for “flame on” is energized.
4. Check and if necessary adjust combustion air capacity to obtain O_2-content selected.
5. Check the temperature and pressures at normal running condition.
6. Check and if necessary adjust the flow through the O_2-analysers' bubbler unit.
7. The plant is now ready for production of inert gas to consumer. If push button "SELECT CONS." is activated, the valve to deck will open.

5.1.5 Topping Up - Inert Gas Generator

1. Follow the procedures described in section 5.1.1 "Before start" and "Normal (auto) start" 1-3.

2. Press SELECT TG MODE touch key. The plant will start automatically by impulse from the inert gas deck line low pressure signal.
3. When the plant is ready for delivery of inert gas to consumer, the valve to deck will open automatically.

5.1.6 Manual start - Inert Gas Generator

1. Carry out checks listed in section 5.1.1 "Before start".
2. Press LOCAL TG START touch key in main panel before MANUAL START/STOP touch key located in front of local TG panel. By maloperation or alarm the lamp will remain unenergized.
3. Check that all air is evacuated from cooling jacket at pipe outlet in sight glass.
4. Start seawater pump and combustion air blower with the touch keys S.W. PUMP and BLOWER.
5. Check and if necessary adjust the flow through the O_2-analysers' bubbler unit.
6. After a prepurging time of 50 seconds start fuel oil pump with touch key F.O. PUMP and energize the ignition glow plug with the key GLOW.
7. Wait approx. 30 seconds and admit fuel oil and air to the ignition burner with touch key IGNITION ON.
8. Wait another 5 seconds and admit fuel oil main burner with the key MAIN BURNER.
9. When flame is established and indicated with LED, allow 5 seconds stabilizing time before stopping ignition burner by depressing the keys GLOW and IGNITION ON.
10. Check and if necessary adjust combustion air capacity to obtain selected oxygen content in the inert gas.
11. Check the temperature and pressures at normal running condition.
12. Check and if necessary adjust the flow through the O_2-analysers' bubbler unit.
13. The plant is ready for production of inert gas to consumer.

5.1.7 Stop of plant

1. Close consumer valve by deenergizing touch key SELECT DECK.
2. The plant can be stopped with touch key STOP.
3. STOP OF PLANT IN F.G. MODE:

   IT IS RECOMMENDED TO CLEAN THE BLOWER.

(Procedure to be followed - Ref. Section 6.0. Maintenance and trouble-shooting).

4. The plant will continue running for a cooling down period except in air venting mode.
5. Control panels shall be left with power on.

5.2 Description instructions for plant start and operation

5.2.1 General

The following start instructions are identical to those presented in the foregoing sections 5.1.2 and 5.1.4, but give more detailed information of the automatic sequence initiated.

5.2.2 Normal (auto) start - Flue gas

Following 5.1.1 "Before start" procedure.

Pressing touch key START FLUE GAS initiates automatically the following start sequence:

The seawater inlet valve will open immediately. 10 secs. later the seawater supply pump will start. 17 sec. delayed the blower will start and valves for uptake will open.

After receiving running signal from blower, the capacity control valve will open to modulating position.

5.2.3 Normal (auto) start - Inert gas generator

Following 5.1.1 "Before start" procedure.

Pressing SELECT TG MODE or AUTO TG START touch key initiates automatically the following start sequence:

The seawater inlet valve will open, and 10 secs. delayed the seawater pump will start. 17 seconds delayed air blower will start and after receiving running signal from blower the burner pressure control valve will open to modulating position. After a pre-purging time of 50 seconds, the glow plug in the ignition burner will be put on and the fuel oil pump will start. 30 seconds delayed from activating the glow plug, fuel oil and air are supplied to the ignition burner and ignited by the glow plug.

5 seconds after activation of ignition burner, fuel oil is supplied to the main burner, and the glow plug will be deactivated. After 4 seconds oil to ignition burner will be switched off, and 10 secs. later air to ignition burner will be switched off.

5.2.4 Operation

When the plant is running, the operator should check and make a record of all values shown on the local mounted instruments.

Any abnormal value must be investigated and the fault corrected as soon as possible.

Should the oxygen content alarm sound during normal operation, the inert gas consumer valve will automatically close, and the atmosphere valve will open. The operator must then adjust the air/diesel ratio, when running in generator mode.

In flue gas, mode boiler burner control must be adjusted.

When the oxygen content is within its limits again, the selected inert gas consumer valve(s) will open automatically.

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6. MAINTENANCE AND TROUBLESHOOTING

6.1 I.M.O. Recommendations

The following is an extract from the I.M.O. Guide-lines for Inert Gas Systems – 1990 Edition.

6.2 General

The safety arrangements are an integral part of the inert gas system and it is important for ship's staff to give special attention to them during any inspection.

Inspection routines for some of the main components are dealt with in this section.

6.3 Burner Scrubber Unit and scrubber unit

Inspection may be made through the manholes. Checks should be made for corrosion attacks, fouling and damage to:

- scrubber shell and bottom;
- cooling water pipes and spray nozzles (fouling);
- level switches and temperature sensors;
- other internals such as trays and demister filters.

Checks should be made for damage to non-metallic parts such as:

- internal linings;
- demisters;
- packed beds.

6.4 Inert Gas Blowers

After use or when found to be necessary, the blowers must be rinsed with fresh water.

NB!

HAMWORTHY AS AS SUPPLIER OF THIS PRODUCT REQUEST CUSTOMERS TO CARRY OUT THE FOLLOWING AS STANDARD ROUTINE:

1. **IF SYSTEM GASES CONTAIN HIGH LEVELS OF SOOT/CARBON, BLOWER SHALL BE CHECKED FOR INCREASED VIBRATION ONCE EVERY HOUR.**
2. **INCREASED VIBRATION IS PROBABLE CAUSE OF BUILD UP OF SOOT/CARBON ON IMPELLER AND/OR LARGE SECTIONS OF THE**

ENCRUSTED SOOT/CARBON FALLING OFF UNDER CLEANING OF IMPELLER IN BLOWER.

3. **IF VIBRATION CONTINUES TO RISE IT IS RECOMMENDED TO THOROUGHLY FOLLOW INSTRUCTIONS BELOW:**

First, the drain valves have to be opened, and the water is injected by opening the valve for fresh water just when the blower(s) are switched off.

The blower impeller will run for some time because of its force due to mass, thus a good cleaning of the internal parts is obtained.

When the impeller stops, the valve for fresh water has to be closed, afterwards the drain valve has to be closed. The cleaning procedure might be repeated if necessary. Inspection to be done through the hatches in blower housing.

It is recommended that after a full unloading of cargo with the inert gas blower in operation, the impeller should be washed.

6.5 Adjustment and tolerances

6.5.1 Oil burner

The oil atomizer position, relative to the air deflecting cone, can be adjusted by loosening the gland nut on the burner gun carrier tube, and move the oil gun outward or inward.

The best position is easiest found if the adjustments are made with the burner in operation, and by measuring the inert gas CO-content.

The correct position is normally indicated by a distinct drop in measured CO-content.

In lack of instrument for measuring the CO-content.

The best position for the atomizer is to be found as follows:

Start the I.G. generator and adjust slowly upward or downward the atomizer and at the same time observe the colour from the sight glass. In the moment the flame is very white and spots around the circumference of the flame turns to be clear/blue, the best position is achieved. Further improvement is only obtained with equipment for measuring of CO-content. The improvement is only in range of some ppm CO.

6.5.2 The Combustion Air System

The combustion air pressure to the main burner is indicated on pressure gauge (Item No. 161).

Normal value, approximately: 0,25 bar g.

The pressure is related to the burner pressure controlled by the PLC.

6.5.3 The Fuel Oil System

The fuel oil pressure to the main burner is indicated on pressure gauge (Item No. 165).

Normal value approx.: 20 bar g.

The pressure may be adjusted on the pressure regulating valve built in the fuel oil pump, but should normally not be touched, once it is set correctly on initial commissioning.

This pressure should equal an oil flow of approx. 40 kg/h.

6.5.4 The Gas System

Gas pressure outlet cooling tower pressure gauge.

Pressure at full capacity:

Approx. 0,12 bar g – Topping up generator (Item No. 220).

Approx. -0,05 bar g - Flue gas scrubber (Item No. 167).

Gas temperature outlet cooling tower (Item No. 179) max 5°C above seawater temperature for both plants.

Gas pressure outlet cooling tower topping up generator is equal to the combustion air pressure, except the pressure loss through the burner and cooling tower.

6.5.5 The Seawater System

Water pressure in cooling jacket:
Pressure gauge (Item No. 162) Approx. 0,4 bar g.

Water pressure to nozzles:
Pressure gauge (Item No. 164) Approx. 2,0 bar g.

6.6 General

The plant particulars to be checked at regular intervals as listed below, and any defects or irregularities found must be rectified as soon as possible.

6.6.1 Items to be checked at regular intervals

In accordance with the maker's specification (Ref. section 11).

1. Electrical motors for:
   - Combustion air blower
   - Fuel oil pump
   - Inert gas blowers
2. Combustion air blower
   - Inert gas blower
3. All pneumatic operated equipment such as:
   - Pressure controllers
   - Valve positioners
   - Fuel oil pump

6.6.2 Other items to be checked regularly

1. Oil strainers

   The filter baskets to be checked and cleaned when necessary in petroleum, diesel oil, white spirit or similar.

2. Oil nozzles (Main and ignition burner).

   The oil nozzles to be disassembled and internals inspected.

   The integrated oil strainer to be cleaned in petroleum, diesel oil, white spirit etc. and blown clean with compressed air.

   All openings and slots in the nozzle must show clean cut, sharp edges.

   The swirl chamber and the outlet orifice to be circular with no signs of ovality.

   NOTE!
   NO STEEL OR METAL WIRE ETC. MUST BE USED TO OPEN DIRTY OR CLOGGED OPENINGS IN THE NOZZLE.

   IT IS ABSOLUTELY ESSENTIAL FOR A GOOD BEHAVIOUR OF THE PLANT THAT THE ATOMIZING NOZZLE IS IN GOOD CONDITION.

3. Filter before O2-analyser.

   The filter can be cleaned as follows:

   Dip the filter into Acetone for 5 - 10 min. Wash the filter in water with a little soap. Then clean the filter in fresh water until all soap (and acetone) is removed. Please note that the filter is of PTFE material and must be handled with care.

4. Water spray nozzle

   The water spray nozzles can be inspected through sight glass in the cooling towers.

   By any signs of clogging or abnormal spray, the nozzles should be removed for inspection and cleaning.

5. Oxygen analyser (Stationary)

   For analyser maintenance and calibration instructions, refer to Section 11.0.

   Ensure that the bubbler unit of the oxygen analyser is filled with fresh water.

   Do not operate the generator with oxygen content lower than 1% by volume.

   If there is an absolute need for a gas with an oxygen content of less than 1 %, the plant may be operated at a lower value, but this may shorten the plant life time.

   By operation at low oxygen values special attention should be paid to the following:

   a. Carefully calibrate the oxygen analyser.
   b. Use a clean oil atomising nozzle in best possible condition.
   c. Ensure stable running conditions.
   d. Sample the gas at regular intervals.
   e. The operator should always be present.

   NOTE!
   THE NO_X AND CO VALUES WILL NORMALLY INCREASE BY DECREASING O_2-VALUES.

6. Valves and equipment

   Normally the valves in the system do not need any regular service, but in order to avoid sticking valves etc., it is recommended that the plant is started for half an hour once a week.

6.7 Deck Water Seal

This unit performs an important function and must be maintained in good condition. Corroded inlet pipes and damage to float-controlled valves are not uncommon. The overboard drain line and connection are also possible sources of trouble.

An inspection of the deck water seal should include:

- Opening for internal inspection to check for:
  - blockage of inlet pipes and housing;
  - corrosion of the venturi lines;
  - Corrosion of heating coils;
  - corroded or sticking floats for water drain and supply valves and level monitoring.
- Functional testing for:
  - automatic filling and draining: check with local level gauge if possible;
  - presence of water carry-over (open drain cocks on inert gas main line) during operation.

6.8 P/V Breaker

To assure that the P/V Breaker can serve its function, all the I.G. branch line shut off valves must be kept open

The seal must be filled with proper liquid (50% ethylene glycol / 50% fresh water) to correct level. This can be done at atmospheric pressure in the deck main line until the level can be seen in the level gauge, at the level indicating arrow.

6.9 Non-return valve(s)

The non-return valve(s) should be opened for inspection to check for corrosion and also to check the condition of the valve seat. The functioning of the valve should be tested in operation.

6.10 Scrubber effluent line

The scrubber effluent line cannot normally be inspected internally except when the ship is in dry dock. The shipside stub piece and the overboard discharge valve should be inspected at each dry-docking period.

6.11 Testing of other units and alarms

A method should be devised to test the correct functioning of all units and alarms and it may be necessary to simulate certain conditions to carry out an effective testing programme.

Such a programme should include checking:

- all alarm and safety functions;
- the functioning of the inert gas isolating valves;
- the operation of all remotely or automatically controlled valves;
- the functioning of the water seal and non-return valves (with a backflow pressure test);
- the vibration level of the inert gas blowers;
- for leakages: in systems four years old or more, deck lines should be examined for leakage;
- the interlocking of soot blowers;
- oxygen measuring equipment, both portable and fixed, for accuracy by means of both air and a suitable calibration gas.

6.12 Suggested maintenance programme by I.M.O.

See next page.

COMPONENT	PREVENTIVE MAINTENANCE	INTERVAL
IG generator isolating valves	Operate the valves	Before start up
	Clean with compressed air of steam	Before operating valve
	Dismantle for inspection and clean	
Scrubber	Water flush	After use
	Cleaning demister	Three months
	Dismantling of level switch and temperature probes for inspection	Six months
	Open for full internal inspection	Dry docking
	Sea water spray nozzles, removal for cleaning	Min. each 3rd month
Overboard pipes and valve from scrubber	Flushing with scrubber water pump for about 1 hour	After use
	Dismantling of the valve for overhaul, inspection of pipeline and overboard end	Dry docking repair period
Blowers	Vibration check	While running
	Flushing	After use
	Internal inspection through hatches	After flushing and six months
	Dismantling for full overhaul of bearings shaft tightening and other necessary work	Two years or more frequently if required
Deck water seal	Dismantling of level regulators/float valves for inspection	Six months
	Opening for internal inspection	One year
	Overhaul of auto valves	One year
Deck mechanical non-return valve	Moving and lubricating valves	One week before start
	Overhaul	One year
	Opening of internal inspection	One year to 18 months
Pressure/vacuum valves	Operating and lubricating	Six months
	Opening for full internal inspection	One year
Deck isolating valve	Open for overhaul	One year
Gas pressure regulating system	Removal of condensation in instrument, air supply	Before start
	Opening of gas pressure regulating valves for overhaul	As appropriate
	Calibrate positioner	Each month
Liquid filled pressure vacuum breaker	Check liquid level when system is at atmospheric pressure	When available and every six months
O_2-analyser panel	Check bubble unit and filter	Each month
	Replace water/add water	
	Wash filter and or replace	
	Calibration by N2 and air	Each month

6.13 Some possible causes of faults during start and operation

6.13.1 If control current is not on

a. Check that fuses are all right.

b. Check that circuit breaker in main switchboard is "ON".

6.13.2 If ignition does not take place

a. Check fuel oil flow.

b. Check that “COMBUSTION AIR PRESSURE” is correct.

c. Check and clean oil nozzle in ignition burner.

d. Check that the ignition glow plug is glowing.

e. Check air to ignition burner.

f. Check and clean main oil nozzle and oil system for possible clogging.

6.13.3 If fuel oil pressure is too low

a. Check that diesel oil pump is running. Diesel oil pump must never run without oil supply.

b. Check that valves are correctly adjusted.

c. Change oil filter with the built-in 3-way valve.

6.13.4 If Seawater pressure is too low

a. Check the seawater supply system.

b. Check that the pressure gauge, pressure switch and pipes are all right and not clogged by salt.

6.13.5 If Seawater level in cooling tower is too high

a. Check that seawater pressure is below approx. 2 bar g.

b. Check that the overboard valve is open.

6.13.6 If inert gas temperature is higher than approx. 5°C above Seawater inlet temperature

a. Check that seawater pressure is 1,5 - 2,0 bar g.

b. Clean the seawater spray nozzles.

6.13.7 If the O_2-content increases and the fuel oil consumption is below normal

a. Check that oil pressure is approx. 20 bar g.

b. Check and clean main oil nozzle.

6.13.8 If the Instrument Air Pressure is too low

a. Check the instrument air supply system: Air pressure should be 6-10 bar g.

b. Reduced to max. 7 bar g by reduction valve (Item No. 262).

6.13.9 If Seawater Temperature Outlet Cooling Jacket (Item No. 178) is higher than approx. 13°C above Seawater Inlet Temperature (Item No. 175)

The s.w. flow through control valve (Item No. 50), mounted in the s.w. line to cooling jacket, to be increased to achieve a temperature difference of approx. 13°C.

NOTE!
THE VALVE MUST BE LOCKED BY MEANS OF LOCKING SCREWS/NUTS LOCATED ON THE GEAR UNIT.

6.13.10 If vibration of I.G. blower occurs

a. Stop the blower and cleaning procedure to be followed: Ref.: Section 6.0 Maintenance and troubleshooting.

6.14 Personnel Qualifications & Training

The service & Maintenance and Operating personnel must be especially qualified for the duties assigned to them. The scope of their responsibility, competence and supervisory duties must be closely controlled by an shift manager or discipline supervisor. If the personnel do not have the required knowledge, they must be trained and instructed. The supervisors must additionally ensure that personnel fully understand the content of the Maintenance Instructions.

6.15 Safety Instructions for Maintenance and Inspection Work

The Operator Company must ensure that all Maintenance and Inspection work is performed by authorized and qualified personnel who have thoroughly studied the Maintenance Instructions.

Work on the IG System is only to be carried out when the System has been shut down. The means of shutting down the System, described in the Instruction of start and stop, must always be followed.

The inert gas system is placed in safe area. However, no work or maintenance creating electric sparks, metallic sparks, hot spots or any other source of gas ignition must be carried out before the area have been declared safe by responsible person. The manufacturer cannot be held responsible for accidents occurring during maintenance.

6.16 Precaution for entering the scrubbers

Since flue gas still can leak from the boiler, the scrubber as well as the topping up generator should be completely gas freed.

Blind flanges should be fitted where applicable or the scrubbers should be completely isolated.

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7. EMERGENCY PROCEDURES

7.1 I.M.O. Recommendations

The following is an extract from the I.M.O. Guide-lines for Inert Gas Systems – 1990 Edition.

7.1.1 In the event of a total failure of the inert gas system to deliver the required quality and quantity of inert gas and maintain a positive pressure in the cargo tanks and slop tanks, action must be taken immediately to prevent any air being drawn into the tank. All cargo tank operations should be stopped, the deck-isolating valve should be closed, and the vent between it and the gas pressure regulating valve should be opened and immediate action should be taken to repair the inert gas system.

7.1.2 In the case of product tankers, it is considered to be totally impracticable to effect a repair to enable the inert gas system to deliver the required quality and quantity of gas and maintain a positive pressure in the cargo tanks, cargo discharge and deballasting may only be resumed provided that either an external supply of inert gas is connected to the system through the arrangements required by regulation 62.11.5, (SOLAS), or the following precautions are taken:

(i) The valves on the vent mast risers are opened,

(ii) No free fall of water or slops is permitted,

(iii) No dipping, ullaging, sampling or other equipment should be introduced into the tank unless essential for the safety of the operation. If it is necessary for such equipment to be introduced into the tank, this should be done only after at least 30 minutes have elapsed since the injection of inert gas ceased. All metal components of equipment to be introduced into the tank should be securely earthed. This restriction should be applied until a period of five hours has elapsed since the injection of inert gas ceased.

7.1.3 In the case of product tankers, if it is essential to clean tanks following a failure of the inert gas system and inerted conditions as defined in regulation 62.2.2 cannot be maintained, tank cleaning should be carried out with an external supply of inert gas connected to the system. Alternatively, if an external supply of inert gas is not connected to the ship, the following precautions should be taken, in addition to those listed in 7.1.2:

(i) Tank washing should be carried out only on one tank at a time.

(ii) The tank should be isolated from other tanks and from any common venting system or the inert gas main and maximum ventilation output should be concentrated on that tank both before and during the washing process. Ventilation should provide as far as possible a free flow of air from one end of the tank to the other.

(iii) The tank bottom should be flushed with water and stripped. The piping system including the cargo pumps, cross-overs and discharge lines should also be flushed with water.

(iv) Washing should not commence until tests have been made at various levels to establish that the vapour content in any part of the tank is below 10% of the lower flammable limit.

(v) Testing of the tank atmosphere should continue during the washing process. If the vapour level rises to within 50% of the lower flammable limit, washing should be discontinued until the vapour level has fallen to 20% of the lower flammable limit.

(vi) If washing machines with individual capacities exceeding 60 m3/hr are to be used, only such machine shall be used at any one time on the ship. If portable machines are used, all hose connections should be made up and bonding cables tested for continuity before the machines are introduced into the tank and should not be broken until after the machines have been removed from the tank.

(vii) The tank should be kept drained during washing. If build-up of wash water occurs, washing should be stopped until the water has been cleared.

(viii) Only clean, cold seawater should be used. Recirculating systems should not be used.

(ix) Chemical additives should not be used.

(x) All deck openings, except those necessary for washing and designed venting arrangements, should be kept closed during the washing process.

7.1.4 During cargo operations in port, more stringent regulations of the port Authorities shall take precedence over any of the foregoing emergency procedures.

7.1.5 The attention of the ship's master should be drawn to regulation 11 (c) of section 1 of the 1978 SOLAS Protocol in the event of the inert gas system having become inoperative.

7.1.6 See also Safety Manual Ch. 13.11, IMO Publication Inert Gas System latest ed.

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8. APPLICATION TO CARGO TANK OPERATION

8.1 I.M.O. Recommendations

The following is an extract from the I.M.O. Guide-lines for Inert Gas Systems – 1990 Edition.

This extract represents what is now generally accepted as standard procedures for the safe operation of **all** inert gas systems.

8.2 Inerting of Tanks

8.2.1 Tanks that have been inerted and gas freed should be re-inerted preferably during the ballast voyage to allow the inert gas system to be fully tested prior to cargo handling. Purge pipes/vents should be opened to atmosphere. When the oxygen concentration of the atmosphere in the tank has fallen below 8% the purge pipe/vents should be closed and the tank pressurised with inert gas.

8.2.2 During the re-inerting of a tank following a breakdown and repair of the inert gas system, non-gas-free and non-inerted tanks should be re-inerted in accordance with 8.2.1. During inerting, no ullaging, dipping, sampling or other equipment should be inserted unless it has been established that the tank is inert. This should be done by monitoring the efflux gas from the tank being inerted until the oxygen content is less than 8% by volume and for such a period of time as determined by previous test records when inerting gas-free tanks to ensure that the flux gas is fully representative of the atmosphere within the tank.

8.2.3 When all tanks have been inerted they should be kept with the inert gas main and maintained at a positive pressure in excess of 100 mm water gauge during the rest of the cycle of operation.

8.3 Discharge of Water Ballast

8.3.1 Before discharge of cargo tank ballast is undertaken, the following conditions should be checked:

- All cargo tanks are connected to the inert gas system and all isolating valves in the deck pipe work are locked open.
- All other cargo tank openings are shut.
- All valves isolating the mast risers from the inert gas system are shut.
- The arrangements required by Regulations 62.13.4.1 are used to isolate the cargo main from the inert gas main.
- The inert gas plant is producing gas of an acceptable quality.
- The deck-isolating valve is open.

8.3.2 During the deballasting operation, the oxygen content of the gas and its pressure in the inert gas main should be continuously recorded.

8.4 Loading

When loading cargo the deck-isolating valve required by Regulation 62.10.8 should be closed and the inert gas plant may be shut down unless other cargo tanks are being de-ballasted simultaneously. All openings to the cargo tanks except those connections to the mast risers or equivalent venting arrangements should be kept closed to minimise flammable vapour on deck. Before loading commences, the flame screens in the mast risers or equivalent venting arrangements should be inspected and any stop valves isolating the cargo tanks from the inert gas main locked in the open position.

8.5 Loaded Condition

8.5.1 During the loaded passage a positive pressure of inert gas of at least 100 mm water gauge should be maintained in the cargo tanks, and topping up of the pressure may be necessary. When topping up the inert gas pressure in the cargo tanks particular attention should be paid to obtaining an oxygen concentration of 5% or less in the inert gas supply before introducing the inert gas into the cargo tanks.

8.6 Cargo Transfer and Cargo Sampling

8.6.1 Ullaging devices of the closed type should be used to avoid the opening of ullage ports.

8.6.2 However, it may be necessary to infrequently relieve the inert gas pressure in the cargo tanks on certain occasions to permit manual tank gauge or cargo sampling before or after cargo is transferred. If this is done, no cargo or ballasting operation is to be undertaken and a minimum number of small tank openings are to be uncovered for as short a time as necessary to enable these measurements to be completed. Manual gauging or cargo sampling may be performed during the following four periods:

- At the loading port, prior to cargo loading.
- At the loading port, after cargo loading.
- At the discharge port, prior to cargo discharge.
- At the discharge port, after cargo discharge.

8.6.3 The tanks should then be re-pressurised immediately after measurements or cargo samples have been taken.

8.6.4 If the tank is opened prior to cargo transfer, cargo transfer should not be commenced until all the conditions have been checked and are in order. Similarly,

if the tank is opened after cargo transfer, normal ship operations should not be commenced until all the conditions have been checked and are in order.

8.6.5 During cargo transfer the oxygen content and pressure of the inert gas in the inert gas main should be continuously recorded.

8.7 Ballasting of Cargo Tanks

The conditions for ballasting of cargo tanks are the same as those for loading in 8.4. When, however, simultaneous discharge and ballasting is adopted, then a close watch should be kept on the inert gas main pressure.

8.8 Ballast Condition

8.8.1 During a ballast voyage, tanks other than those required to be gas free for necessary tank entry should be kept inerted with the cargo tank atmosphere at a positive pressure of not less than 100 mm water gauge having an oxygen level not exceeding 8% by volume during tank cleaning.

8.8.2 Before any inert gas is introduced into cargo tanks to maintain a positive pressure it should be established that the inert gas contains not more than 5% by volume of oxygen.

8.9 Tank Cleaning

Cargo tanks should be washed in the inert condition and under a positive pressure. Before each tank is washed, the oxygen level shall be determined at a point 1 metre below the deck and at the middle region of the ullage space and neither of these determinations shall exceed 8% by volume. Where tanks have complete or partial wash bulkhead, the determination should be taken from similar levels in each section of the tank. The oxygen content and pressure of the inert gas being delivered during the washing process should be continuously recorded.

If during the washing process:

- the oxygen level of the inert gas being delivered exceed 8% by volume; or
- the pressure of the atmosphere in the tanks is no longer positive;

the washing must be stopped until satisfactory conditions are restored.

8.10 Purging Prior to Gas-Freeing

When it is desired to gas free a tank after washing, the concentration of hydrocarbon vapour should be reduced by purging the inerted cargo tank with inert gas. Purge pipes/vents should be opened to atmosphere and inert gas introduced into the tank until the hydrocarbon vapour concentration measured in the efflux gas has been reduced to 2% by volume and until such time as determined by previous test on cargo tanks has elapsed to ensure that readings

have stabilised and the flux gas is representative of the atmosphere within the tank.

8.11 Gas-Freeing

8.11.1 Gas-freeing of cargo tanks should only be carried out when tank entry is necessary (e.g. for essential repairs). It should not be started until it is established that a flammable atmosphere in the tank will not be created as a result. Hydrocarbon gases should be purged from the tank (see 8.10).

8.11.2 Gas-freeing may be effected by pneumatically, hydraulically, or steam driven portable blowers, or by fixed equipment. In either case it is necessary to isolate the appropriate tanks to avoid contamination from the inert gas main.

8.11.3 Gas-freeing should continue until the entire tank has an oxygen content of 21% by volume and a reading of less than 1% of lower flammable limit is obtained on a combustible gas indicator. Care must be taken to prevent the leakage of air into inerted tanks, or of inert gas into tanks, which are, being gas freed.

8.12 Tank Entry

8.12.1 The entry of personnel into the cargo tank should be carried out only under the close supervision of a responsible ship's officer and in accordance with national rules and/or with the normal industrial practice laid down in the INTERNATIONAL SAFETY GUIDE FOR OIL TANKERS AND TERMINALS. The particular hazards encountered in tanks, which have been previously inerted and then gas-freed are outlined in 9.2.8, 9.3.3 and section 10 of that guide.

Practical precautions to meet these hazards include:

- securing the inert gas branch line gas valves and/or blanks in position or, if gas-freeing with the inert gas blower, isolating the scrubber from the flue gases;
- closing of any drain lines entering the tank from the inert gas main;
- securing relevant cargo line valves or controls in the closed position;
- keeping the inert gas deck pressure in the remainder of the cargo tank system at a low pressure such as 200 mm water gauge. This minimises the possible leakage of inert or hydrocarbon gas from other tanks through possible bulkhead cracks, cargo lines, valves etc.;
- lowering clean sample lines well into the lower regions of the tank in at least two locations. These locations should be away from both the inlet and outlet openings used for gas freeing. After it has been ascertained that a true bottom sample is being obtained, the following readings are required:
    - 21% on a portable oxygen analyser; and
    - less than 1% of lower flammable limit on a combustible gas indicator;

- the use of breathing apparatus whenever there is any doubt about the tank being gas-free, e.g. in tanks where it is not possible to sample remote locations. (The practice should be continued until all areas, including the bottom structure, have been thoroughly checked);
- continuously ventilating and regularly sampling the tank atmosphere whenever personnel are in the tank;
- carefully observing normal regulations for tank entry.

8.13 Re-Inerting after Tank Entry

8.13.1 When all personnel have left the tank and the equipment has been removed, the inert gas branch line blank, if fitted, should be removed, the hatch lids closed and the gas pressure regulating valve re-opened and locked open to the inert gas main where appropriate. This will avoid any risk of structural damage when liquids are subsequently handled.

8.13.2 As soon as a gas-free tank is reconnected to the inert gas main it should be re-inerted to prevent transfer of air to other tanks.

8.14 Special Notes concerning Product Carriers

8.14.1 Product carriers may carry petroleum products having a flash point exceeding 60°C – bitumens, lubricating oils, heavy fuel oils, high flashpoint jet fuels and some diesel fuels, gas oils and special boiling point liquids without having to keep the tanks in an inerted condition.

8.14.2 If cargoes with a flashpoint exceeding 60°C, whenever heated or otherwise, are carried at temperatures near to or above their flashpoint (some bitumen cut backs and fuel oils), a flammable atmosphere can occur (regulation 62.1 refers). When cargoes with a flash point exceeding 60°C are carried at a temperature higher than 5°C below their flashpoint they should be carried in an inerted condition.

8.14.3 When a non-volatile cargo is carried in a tank that has not been previously gas-freed, then that tank shall be maintained in an inert condition.

8.14.4 Contamination of a product may affect its odour, acidity or flashpoint specifications and may occur in several ways; those relevant to ships with an inert has main (or other gas line) interconnecting all cargo tanks are;

(i) Liquid contamination due to overfilling a tank.

(ii) Vapour contamination through the inert gas main. This is largely a problem of preventing vapour from low flashpoint cargoes, typically gasolines, contaminating the various high flashpoint cargoes, e.g. aviation gasolines and most hydrocarbon solvents. This problem can be overcome by;

- removing vapours of low flashpoint cargoes prior to loading; and
- preventing ingress of vapours of low flashpoint cargoes during loading and during the loaded voyage.

When carrying hydrocarbon solvents where quality specifications are stringent and where it is necessary to keep individual tanks positively isolated from the inert gas main after a cargo has been loaded, pressure sensors should be fitted so that the pressure in each such tank can be monitored. When it is necessary to top up the relevant tanks, the inert gas main should fist be purged of cargo vapour.

8.14.5 Experience suggests that petroleum cargoes do not suffer from contamination by inert gas, but in this context it is important to ensure that the inert gas generator burner or flue gas system is operating efficiently and that the scrubber is well maintained at all times.

8.14.6 All lubricating oils and jet fuels are acutely water-critical. Current practice requires full line draining and mopping up of any water in tanks before loading. Water contamination may occur on inerted ships due to water carried over from the scrubber and/or deck water seals due to inadequacies in design or maintenance of the drying arrangements.

8.14.7 All gas-freeing operations must be preceded by a purging operation, but gas-freeing for purely quality reasons may be replaced by purging only. In addition purging may be required when a non-volatile cargo is carried in a tank, which has not been previously gas-freed.

It should be recognised that:

(i) there are increased risks of air leaking into inert tanks and of inert gas leaking into a tank being entered;

(ii) purging is not a prerequisite of gas-freeing when the hydrocarbon gas content of a tank is below 2% by volume;

(iii) The operation of gas-freeing for product purity and where tank entry is not contemplated does not require the atmosphere to have an oxygen content of 21% by volume.

8.15 Cargo-Ballast Operation Manual

INSTRUCTIONS TO BE INSERTED BY YARD/OWNER ACCORDING TO SOLAS REGULATION, INCLUDING THE ITEMS SPECIFIED IN MSC/CIRK.353.

8.16 Application to Double Hull Spaces

References should be made to the relevant parts of the vessel operation manual.

Inerting, ventilation and gas measurement

According to SOLAS Regulation II-2/59.4 (Consolidated Edition, 2001):

"4.1 This paragraph shall apply to oil tankers constructed on or after 1 October 1994.

4.2 Double hull and double bottom spaces shall be fitted with suitable connections for the supply of air.

4.3 On tankers required to be fitted with inert gas systems:

1. double hull spaces shall be fitted with suitable connections for the supply of inert gas;
2. where hull spaces are connected to a permanently fitted inert gas distribution system, means shall be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system;
3. where such spaces are not permanently connected to an inert gas distribution system, appropriate means shall be provided to allow connection to the inert gas main.

4.4.1 Suitable portable instruments for measuring oxygen and flammable vapour concentrations shall be provided. In selecting these instruments, due attention shall be given to their use in combination with the fixed gas sampling-line systems referred to in paragraph 4.4.2.

4.4.2 Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. The configuration of such line systems shall be adapted to the design of such spaces.

4.4.3 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where plastic materials are used, they should be electrically conductive."

Gas Freeing and Ventilation

The gas freeing and ventilation arrangements must be capable of gas freeing:

1. Inerted double hull spaces; and
2. Double hull spaces containing cargo vapours from leakages in cargo into the spaces;

in order to maintain adequate ventilation continuously during entry of personnel.

Alternative Methods of Ventilation

The following methods of ventilation are feasible;

1. Filling and subsequent emptying with water ballast,
2. Using portable gas-feeing fan fitted to tank openings with hose or pipe led to bottom of the tank. Discharge may be through hatch or manhole (see Fig. 1).

   Pipes made of non-metallic material may be accepted if documented to be of electrically conductive type and suitably grounded. For acceptable results in larger L-shaped tanks, the purge pipes should be led inboard to the centreline double bottom girder. An alternative to portable fans is to use inert gas fans;

3. Same arrangement as 2. above, however, extraction from bottom through purge pipe and fresh air supply from deck (see Fig. 2);
4. Connection between the inert gas line and the water ballast line for fresh air supply through ballast line for fresh air supply through ballast suctions (see Fig. 3);
5. Crossover ventilation (see Fig. 4);
6. An arrangement utilizing dilution method with inlet and outlet at deck level. This method will require a powerful fan so that the jet will penetrate all the way down to the tank bottom.

   The high inlet velocity causes turbulent mixing with the tank atmosphere. The gas being exhausted from the tank is at nay time a mixture of the gas supplied and the tank atmosphere. For L-shaped tanks this method alone is normally not considered sufficient, but in combination with air supply through ballast suctions, it may be acceptable; and

7. Combination of partly filling and ventilation, e.g. filling of double bottom section of U-shaped tanks and ventilation of side spaces.

Methods listed in 1 to 5 are based on displacement of gas, which is considered to be the best solution of deep tanks of cellular design.

Most hydrocarbon gases from crude oil, hydrogen sulphide and inert gas are heavier than air. With requirements for connections for inert gas supply to ballast tanks, inerting of ballast tank will probably be a normal procedure. A ventilation arrangement extracting the heavier gasses from bottom utilizing portable fans mounted on purge pipes and with fresh air supply from open hatches in deck will probably be an effective gas-freeing method.

However, filling of ballast tanks and subsequent emptying is considered as most efficient way of gas-freeing ballast tanks. Hull strength limitations must be observed.

Inerting

The arrangements for inerting of double hull spaces may be through portable connections to the inert gas system for cargo tanks or by fixed piping connections.

If fixed piping is used, the arrangement must include a separate deck water seal and a non-return valve in order to prevent communications between vapour spaces of cargo tanks and the double hull spaces. The practices for inerting double hull spaces may either be to keep these spaces inerted at all times when empty, or to inert them only if hydrocarbon gases are detected indicating leakage between cargo tank(s) and the double hull spaces. If the former practice is utilized, a fixed piping system is considered necessary.

Methods and Arrangements for Inerting

As for gas freeing and ventilation the easiest method for inerting is to supply inert gas to the space during de-ballasting. For that purpose an inert gas inlet in the top of the space is needed. However, arrangements must additionally, be provided to enable the space to be purged with inert gas. For this purpose at least L-shaped tanks must be provided with inert gas supply outlets near bottom far ends.

Alternative arrangements for inert gas purging will be the same as for ventilation purposes detailed in paragraphs 4, 5, 6 and 7, replacing portable fan with inert gas supply inlets.

Operational Procedures

Written procedures should be available onboard giving details on how to carry out ventilation, inerting and cleaning of double hull spaces.

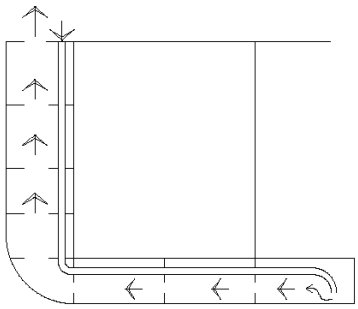

Figure 1 Ventilation by means of portable fan/inert gas fan and purge pipe

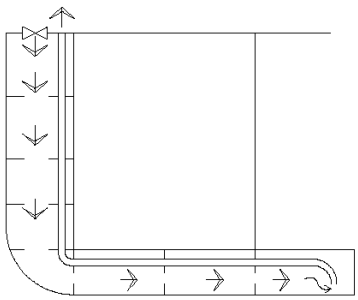

Figure 2 Gas freeing by means of portable fan and purge pipe

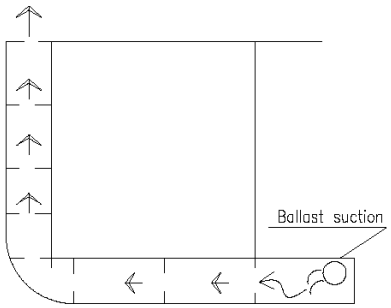

Figure 3 Ventilation with supply from inert gas fan through ballast suction

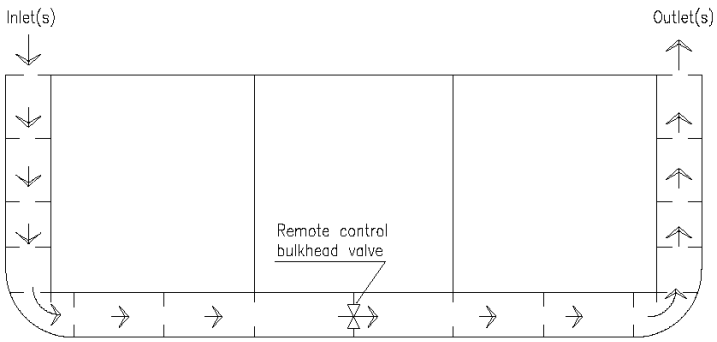

Figure 4 Cross-over ventilation through remote operated bulkhead valve(s)

LIST OF DRAWINGS

Drawing no.:	Rev:	Description:
130959	02	Parts List - Flue Gas/Topping Up
M1300-007std	01	Symbol table
130959-100-01	00	P & I Diagram - Flue Gas
130959-101-01	00	P & I Diagram - Topping Up
130959-050-01	01	Burner/Scrubber Unit, Arr., Item No. 253
130959-051-01	01	Scrubber Unit, Arrangement, Item No. 253
130959-052-01	02	Deck Water Seal, Arrangement, Item No. 250
130959-053-01	03	Press./Vacuum breaker, Arr., Item No. 252
M1295-000std	01	Fuel Oil Pump Unit, Arr., Item No. 229
130959-059-01	00	Pneumatic Panel, Item No. 231
130959-081-01	00	Customer’s Pneumatic Connections
77-058-01	03	Oxygen Analyser Panel

Hamworthy
Moss

Parts List

12/5/2008

Stock Type
0 = Purchase Order Point
1 = Purchase Planning
2 = Purchase As Needed
10 = Manufactured Order Point
11 = Manufactured Planning
12 = Manufactured As Needed
99 = Non Deliverable Items

Supply
A - Fitted Supply
B - Loose Items Supply
C - Owner / Shipyard Supply
S - Loose Items Supply

Order No: **130959** FG10000-16 (8600-13590 Nm3/h)

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
1	120-10	1	N8661-001	Shut off valve assembly DN400	Fig. 15-133 (Spring close)	Flange: DIN PN10	Inert gas main	B	2	
		1	M2270-002	Butterfly valve DN400	Fig. 15-133 w/undercut	Flange: DIN PN10		A	2	
		1	N2811-001	Pneumatic actuator	Fig. 79E-180S			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
2	120-40	1	N8441-004	Control valve assembly DN300	Fig. 14-133	Flange: DIN PN10	Vent to atmosphere	B	2	
		1	M2480-001	Butterfly valve DN300	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1013-001	Pneumatic actuator	Fig. 79E-065			A	2	
		1	M1014-003	Positioner with limit switch	Fig. 793-011M 15-3psi	Supply:1/4"BSP, Signal:1/8"BSP		A	2	
		1	M0110-002	I/P converter	V18312-12221190	4-20mA/3-15 psi		A	0	
		1	M0122-001	Pressure gauge, dia. 50mm	Scale 0-30 psi/0-200 kPa	Connect: 1/4" BSP		A	0	
		1	M1815-001	Manual override kit	with release valve			A	2	
4	140-60	1	N8447-001	Shut off valve assembly DN65	Fig. 14-133	Flange: DIN PN10	Sealing air to I.G. uptake line	B	2	
		1	M5010-001	Butterfly valve DN65	Fig. 14-133	Flange: DIN PN10/16		A	2	
		1	M1024-001	Pneumatic actuator	Fig. 79E-003			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
5	60-20	1	N8667-001	Shut off valve assembly DN150	Fig. 14-133	Flange: DIN PN10	Sea water main inlet scrubber	A	2	
		1	M1093-001	Butterfly valve DN150	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1096-001	Pneumatic actuator	Fig. 79E-012			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
		2	M1018-003	Speed control	for Solenoid valve Fig. 791/B			A	2	
7	120-90	1	N8235-003	Control valve assembly DN250	Fig. 14-133	Flange: DIN PN10	Blower No. 1 outlet	B	2	
		1	M2482-001	Butterfly valve DN250	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1023-001	Pneumatic actuator	For DN 250 Valve			A	2	

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Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
		1	M1014-001	Positioner with limit switch	Fig. 793-011M 3-15psi	Supply:1/4"BSP, Signal:1/8"BSP		A	2	
		1	M0110-002	I/P converter	V18312-12221190	4-20mA/3-15 psi		A	0	
		1	M0122-001	Pressure gauge, dia. 50mm	Scale 0-30 psi/0-200 kPa	Connect: 1/4" BSP		A	0	
		1	M1815-001	Manual override kit	with release valve			A	2	
8	120-100	1	N8235-003	Control valve assembly DN250	Fig. 14-133	Flange: DIN PN10	Blower No. 2 outlet	B	2	
		1	M2482-001	Butterfly valve DN250	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1023-001	Pneumatic actuator	For DN 250 Valve			A	2	
		1	M1014-001	Positioner with limit switch	Fig. 793-011M 3-15psi	Supply:1/4"BSP, Signal:1/8"BSP		A	2	
		1	M0110-002	I/P converter	V18312-12221190	4-20mA/3-15 psi		A	0	
		1	M0122-001	Pressure gauge, dia. 50mm	Scale 0-30 psi/0-200 kPa	Connect: 1/4" BSP		A	0	
		1	M1815-001	Manual override kit	with release valve			A	2	
10	120-20	1	M6560-004	Shut off valve assembly DN300	Fig. 14-133	Flange: DIN PN10	Blower No. 1 inlet	B	2	
		1	M2480-001	Butterfly valve DN300	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1021-001	Gear	Fig. 455-WMK009	For DN200 - 300 mm		A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
11	120-30	1	M6560-004	Shut off valve assembly DN300	Fig. 14-133	Flange: DIN PN10	Blower No. 2 inlet	B	2	
		1	M2480-001	Butterfly valve DN300	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1021-001	Gear	Fig. 455-WMK009	For DN200 - 300 mm		A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
13	0-0	1	M3165-001	Shut off valve	Deck isolating valve		Deck isolating valve	C	99	
14		1	M1022-001	Limit switch					99	
		1	M1390-001	Shut off valve	Sea water scrubber overboard				99	
15		1	M1150-015	Shut off/non return valve	Sea water DWS overboard				99	
16		1	M1011-016	Shut off valve	Sea water inlet from sea chest		Sea water inlet from sea chest	C	99	
18		1	M1011-018	Shut off/non return valve	Sea water pump outlet		Sea water pump outlet	C	99	
19		1	M1022-001	Limit switch					99	
		1	M7244-001	Shut off/non return valve	Sea water aux. supply				99	
20		2	M1011-020	Shut off valve	Sea water inlet DWS pumps		Sea water inlet DWS pumps	C	99	

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
21		2	M1011-021	Shut off/non return valve	Sea water outlet DWS pumps		Sea water outlet DWS pumps	C	99	
24	140-20	2	N8658-001	Uptake valve assembly DN400		Flange: DIN PN10	Boiler uptake 1 and 2	B	12	
		1	M3168-004	Butterfly uptake valve DN400	Mod: VR-7890 Swing Through	Flange: DIN PN10		A	2	
		1	M1096-001	Pneumatic actuator	Fig. 79E-012			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
26	140-30	1	N8658-001	Uptake valve assembly DN400		Flange: DIN PN10	Boiler uptake common line	B	12	
		1	M3168-004	Butterfly uptake valve DN400	Mod: VR-7890 Swing Through	Flange: DIN PN10		A	2	
		1	M1096-001	Pneumatic actuator	Fig. 79E-012			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
30	90-140	1	M0820-001	Shut off/non return valve 1"	BGV-456022NR PN16 RG5 19C	Connect: 1" BSP	S. W. to deck water seal	B	0	
34	180-10	1	M0827-001	Shut off valve 3/4"	Brass. A: CIM 70/BS	Connect: 3/4" BSP	Drain of DWS	A	0	
39	160-10	2	M0820-001	Shut off/non return valve 1"	BGV-456022NR PN16 RG5 19C	Connect: 1" BSP	Steam for cleaning uptake valve	B	0	
40	80-10	1	M0830-001	Test cock valve	Brass	Connect: 1/4" BSP	For PS 183	A	0	
41	60-20	2	M0832-001	Test cock valve DN8	Type 7.6645	Connect: 1/4" BSP		A	0	
42	90-150	5	M0832-001	Test cock valve DN8	Type 7.6645	Connect: 1/4" BSP		B	0	
43	80-10	1	M0826-001	Shut off valve 1/2"	Brass. A: CIM 70/BS	Connect: 1/2" BSP	Instrument air inlet	A	0	
47	120-80	1	N8440-001	Shut off valve assembly DN50	Fig. 14-133 (Spring open)	Flange: DIN PN10	Vent to I.G. main	B	2	
		1	M1302-001	Butterfly valve DN50	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M6724-001	Pneumatic actuator	Fig. 79E-006S Spring open			A	2	
48	50-90	2	N2863-001	Butterfly valve DN50	Fig. 14-133	Flange: DIN PN10	Drain condensate/F.W washing I.G. blowers	B	2	
		1	M1302-001	Butterfly valve DN50	Fig. 14-133	Flange: DIN PN10			2	
		1	M1106-001	Lever handle	Fig. 412-015S DI/SS DN 40-50	for manual operation			2	
53	160-20	1	N8740-001	Ball valve DN25 assembly	Closed, F180	Connect: 1" BSP	Steam for cleaning uptake valves	B	2	
		1	N8741-001	Ball valve DN25	F180 Full Bore	Connect: 1" BSP		A	2	
		1	N9365-001	Pneumatic actuator	PRA-002			A	2	

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Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
54	0-0	2	M4569-001	Shut off valve	Steam for heating of DWS		Steam for heating of DWS	C	99	
64	180-20	1	M0062-001	Non return valve DN400	Material: COR-TEN / AISI 316	Flange DIN PN10	For Inert Gas main line	B	0	
84	50-100	1	M6643-001	Flexible hose w/couplings	1/2" x 5m		For blower flushing	B	2	
		2	M0838-001	Hose claw coupling			Connected to hose	A	0	
85	50-20	2	M0835-001	Male claw coupling	Kag 12 R 1/2"			A	0	
86		2	M0818-001	Shut off/non return valve 1/2"	BGV-456022NR PN16 RG5 19C	Connect: 1/2" BSP	I.G. blower flushing	A	0	
100		1	M7831-003	Fan DN300	BK 25-1	Flange: DIN PN10	Blower No 1	B	2	
101		1	M7831-003	Fan DN300	BK 25-1	Flange: DIN PN10	Blower No 2	B	2	
103		1	M8767-001	El. motor	M3BP 225 SMC2	65 kW 440V 60Hz IP55	El. motor blower No. 1	A	2	
104		1	M8767-001	El. motor	M3BP 225 SMC2	65 kW 440V 60Hz IP55	El. motor blower No. 2	A	2	
105	50-50	6	M1167-001	Resilient mounting	RA 350A w/stop			B	2	
106	50-60	6	M1167-001	Resilient mounting	RA 350A w/stop			B	2	
107	50-70	2	M7676-001	Flexible bellow, DN300	Tuboflex T-49 yellow/NBR	Flange: DIN PN10	Inlet I.G. Fan No. 1 and 2	B	2	
108	50-80	2	M7676-001	Flexible bellow, DN300	Tuboflex T-49 yellow/NBR	Flange: DIN PN10	Outlet I.G. Fan No. 1 and 2	B	2	
110	0-0	1	M8484-001	Axial compensation				C	99	
111		1	M8484-001	Axial compensation				C	99	
112		1	M8484-001	Axial compensation				C	99	
114	60-20	1	M0239-001s	Sight glass DN400	NS 6141/ISO 1751-A400-LW	Connect: welding type, DN400		A	0	
115	180-10	1	M0239-001s	Sight glass DN400	NS 6141/ISO 1751-A400-LW	Connect: welding type, DN400		A	0	
116	60-20	1	M1214-001s	Sea water spray nozzle	Moss-2 1/2 -60-24, 60°	Connect: 2 1/2" BSP		A	2	
117		8	M1348-001s	Sea water spray nozzle	Moss-2-90-15, 90°	Connect.: 2" BSP		A	2	
122	0-0	1	M1011-122	Filter, sea water inlet				C	99	
125		2	M1011-125	Sea water pump	Supply to DWS		Supply to DWS	C	99	

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
126		2	M1011-126	El. motor	For DWS sea water pump		For DWS sea water pump	C	99	
128		1	M1011-128	Sea water pump	Supply to Scrubber		Supply to Scrubber	C	99	
129		1	M1011-129	El. motor	For Scrubber sea water pump		For Scrubber sea water pump	C	99	
130	60-20	1	M1199-001	Wet filter for scrubber	1588x458x200			A	2	
131		1	M1879-001	Demister for Scrubber	1588x458x150			A	2	
132	180-10	1	M1334-001	Demister section for DWS	1588x434x150			A	2	
141	80-10	1	N3295-002	Solenoid valve 3/2-way NC air	SCE374A017MS 24V DC 10bar	1/4" BSP Material: Brass	Air supply to item 1 and 47	A	0	
160		1	M0121-001	Pressure gauge, dia. 63mm	Scale 0-10 bar / 0-1 MPa	Connect: 1/4" BSP AISI 316	Instrument air inlet	A	0	
161	60-10	0	M0120-001	Pressure gauge, dia. 100mm	Scale -0,4+0,6 bar/-40+60 kPa	Connect: 1/4" BSP	Exhaust gas	A	0	
	60-20	1	M0120-001	Pressure gauge, dia. 100mm	Scale -0,4+0,6 bar/-40+60 kPa	Connect: 1/4" BSP	Exhaust gas	A	0	
163	90-10	1	M0120-001	Pressure gauge, dia. 100mm	Scale -0,4+0,6 bar/-40+60 kPa	Connect: 1/4" BSP	I.G. outlet blowers	B	0	
164	60-20	1	M0117-001	Pressure gauge, dia. 63mm	Scale 0-4 bar / 0-400 kPa	Connect: 1/4" BSP AISI 316	Sea water main inlet scrubber	A	0	
167	90-20	1	M0120-001	Pressure gauge, dia. 100mm	Scale -0,4+0,6 bar/-40+60 kPa	Connect: 1/4" BSP	I.G. outlet scrubber	B	0	
169	90-30	1	M0117-001	Pressure gauge, dia. 63mm	Scale 0-4 bar / 0-400 kPa	Connect: 1/4" BSP AISI 316	Sea water to D.W.S.	B	0	
175	60-20	1	M0124-001	Thermometer 0-100°C	Straight type, L=63mm	Connect: 1/2" BSP	Sea water main inlet scrubber	A	0	
176	90-40	1	M0126-001	Hot gas thermometer 50-650°C	Sensor length 300mm x 3/4"R	Connect: 3/4" BSP	Exhaust gas	B	0	
177	90-50	1	M0125-001	Thermometer 0-100°C	Angle type 90, L=63mm	Connect: 1/2" BSP	I.G. outlet blower 1	B	0	
178	90-160	1	M0125-001	Thermometer 0-100°C	Angle type 90, L=63mm	Connect: 1/2" BSP	I.G. outlet blower 2	B	0	
179	90-60	1	M0124-001	Thermometer 0-100°C	Straight type, L=63mm	Connect: 1/2" BSP	I.G. outlet scrubber	B	0	
182	90-80	1	M0111-001	Pressure transmitter EEx ia II		IG/air press -500/+2500 mmWG	I.G.pressure in deck main line To be protecyed against weather Setpoint 50/1450 mmWG	B	0	

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Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
	90-70	1	M0085-001	Bracket for press. transmitter				B	0	
183	80-10	1	M0165-001	Pressure switch 3,45-8,34 bar	4140C K1E12 AAO-EE	Connect: 1/8" BSP	Low instrument air pressure Setpoint 5,0 bar	A	0	
184	60-20	1	M0169-001	Pressure switch 0.1-2.1 bar	P1H-B30-SS	Connect: 1/4" NPT	Low S.W. pressure inlet scrubber Setpoint 0,7 bar	A	0	
187	90-90	1	M0167-001	Pressure switch -0.2/+0.2 bar	D1T-M3-SS-Exi	Connect: 1/4" BSP	Low I.G. pressure in deck main To be protected against weather. Setpoint 100 mmWG.	B	0	
188	90-100	1	M0171-001	Temp. transmitter 0-100°C	PT 100, 4-20mA, L=250	Connect: 1/2" BSP	High I.G. temp. Setpoint 65 °C.	B	0	
189	90-110	1	M0169-001	Pressure switch 0.1-2.1 bar	P1H-B30-SS	Connect: 1/4" NPT	Low S.W. pressure to DWS Setpoint 0,7 bar.	B	0	
192	60-20	1	M0164-001	Temperature switch 49-71*C	4140D K1EOOCE2-EE	Connect: 1/2" BSP	High I.G. temp. in scrubber Setpoint 55°C.	A	0	
193		1	M0181-001	Level switch	Type 003S	Connect: 1" BSP	High S.W. level scrubber	A	0	
194	180-10	1	M0182-002	Level switch	Squing-2	Connect.: 1" BSP	Low S.W. level in DWS	A	0	
206	0-0	1	M0234-002	Pressure regulator valve	for Nitrogen gas bottle				2	
207		1	M0233-002	Span gas bottle nitrogen	Bottle				2	
231	80-10	1	M1176-001	Pneumatic Panel				B	12	
232	100-10	1	N9374-001	Oxygen Analyzer panel	Moss IGS Analyser 3500			B	0	
233	70-10	1	M1606-001	Main control panel	FG+TUG			B	2	
234	70-30	1	M1699-003	Local panel T.U.G				A	2	
237	70-70	1	M1053-001	Power distribution panel				B	2	
238	70-90	1	M1054-001	Intrinsic Safe Panel				B	2	
239	70-110	1	M1052-004	Sub panel in Wheel House	Flush mounting			B	2	
240	70-120	1	M1698-004	Sub panel in EC Room	Flush mounting			B	2	
241	110-10	1	M1632-001	Starter blower	DOL- max. 100kW 185A		Starter blower 1	B	2	
242	110-20	1	M1632-001	Starter blower	DOL- max. 100kW 185A		Starter blower 2	B	2	

Order No: **130959** FG10000-16 (8600-13590 Nm3/h)

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
249	70-130	1	M0190-001	Alarm sirene	Type: 172.24	24V DC		B	0	
250	180-10	1	M1289-001	Deck Water Seal	DWS - Nom. size: 10000Nm3/h-16				2	
252	170-10	0	M1274-001	P/V Breaker	Nom. size: DN400			B	2	
253	60-20	1	M1283-001	Scrubber Unit	FG - Nom. size: 10 000Nm3/h-16	FG9490			2	
254	120-50	1	M1131-001	Name plates for loose items	Plastic, laminated	70x20mm, Øhull=3,5mm, C/C=60mm		B	2	
	120-70	1	M8001-001	Engraving av Tag plate	Hamworthy Moss standard			B	2	
	240-30	0	M1847-001	Engraving Company name plate				B	2	
256	130-10	1	N9095-001	Hydro Carbon/O2 analyzer-port	Model RX-415			B	2	
	130-20	1	N9095-002	Sample hose 30m for RX-415				B	2	
	130-30	2	N9095-003	Sample bag for RX-415	2 litre			B	2	
260	140-50	1	M2394-001	Hatch DN350 w/steel frame	NS 6141- A300 - LW		For air vent	B	2	
	140-40	1	M1077-001	Limit switch for air sealing	XCK-J 161			B	2	
262	80-10	1	M1833-001	Reduction valve w/filter 1/2"	C15, G1/2", 535 132 021 0			A	0	
264	90-120	1	M0255-001	Vacuum valve DN15		Connect: 1/2" BSP		B	0	
265	90-130	1	M0078-001	Flame Arrestor NS-2527 DN50	Flange: DIN PN10			B	10	
900	190-10	1	M1080-001	Spare parts box	Model 23-20, 200x350x200			B	2	
908	190-20	1	M8020-001	Chart paper, fan fold PHC33			Spare for recorder Fuji PHC33	B	0	
	190-30	1	M8023-001	Ink cartridge PHC33	with ink absorption cloth incl		Spare for recorder Fuji PHC33	B	0	
912	190-40	1	M1129-001	Ball bearing	6312/C3		Spare part Non-Drive end	B	2	
913	190-50	1	M2423-001	Ball bearing	6313/C3		Spare part Drive end	B	2	
1005	220-10	1	N8777-001	Shut off valve assembly DN80	Fig. 14-133	Flange: DIN PN10	Sea water inlet scrubber	A	2	
		1	M2474-001	Butterfly valve DN80	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1017-001	Pneumatic actuator	Fig. 79E-006			A	2	
		1	M1015-001	Limit switch box w/2xV9 switch	Fig. 792 LP			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	
1006		1	N8162-006	Control valve assembly DN80	Fig. 14-133	Flange: DIN PN10	Inert gas capacity	A	2	
		1	M2474-001	Butterfly valve DN80	Fig. 14-133	Flange: DIN PN10		A	2	

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
		1	M1017-001	Pneumatic actuator	Fig. 79E-006			A	2	
		1	M1014-003	Positioner with limit switch	Fig. 793-011M 15-3psi	Supply:1/4"BSP, Signal:1/8"BSP		A	2	
		1	M0110-002	I/P converter	V18312-12221190	4-20mA/3-15 psi		A	0	
		1	M0122-001	Pressure gauge, dia. 50mm	Scale 0-30 psi/0-200 kPa	Connect: 1/4" BSP		A	0	
		1	M6910-001	Manual override kit <- DN125	for F79E-003/006/012	with release valve		A	2	
1012		1	M0816-001	Control valve 1"	BGV-456022 PN16 RG5	Connect: 1" BSP	Combustion air to atmosphere	A	0	
1014	0-0	1	M1390-002	Shut off/non-return valve	Sea water scrubber overboard				99	
1017		1	M1011-018	Shut off/non return valve	Sea water pump outlet				99	
1028		1	M1011-016	Shut off valve	Sea water inlet from sea chest				99	
1032	220-10	2	M0828-001	Shut off valve 1"	Brass. A: CIM 70/BS	Connect: 1" BSP	For sight glass	A	0	
1035		1	M0826-001	Shut off valve 1/2"	Brass. A: CIM 70/BS	Connect: 1/2" BSP	Secondary air to burner	A	0	
1040		1	M0830-001	Test cock valve	Brass	Connect: 1/4" BSP	Gauges and switches	A	0	
1041		4	M0832-001	Test cock valve DN8	Type 7.6645	Connect: 1/4" BSP	Gauges and switches	A	0	
1045		2	M0825-001	Shut off valve 3/8"	Brass. A: CIM 70/BS	Connect: 3/8" BSP	Air for cleaning of sight glass	A	0	
1050		1	M1301-001	Control valve assembly DN50	Fig. 14-133	Flange: DIN PN10	Seawater inlet	A	2	
		1	M1302-001	Butterfly valve DN50	Fig. 14-133	Flange: DIN PN10		A	2	
		1	M1103-001	Gear	Type QE4			A	2	
		1	M1103-002	Long locking bolts for gear				A	2	
1052		1	M0338-001	Silencer/spark arrestor	For 1" SM			A	0	
1062		1	M0824-001	Control valve PN100	TA-52475-308	Connect: 1/4" BSP	Air to ignition burner	A	0	
1066		2	M0138-001	Non return valve	Type RHD 8 L	Connect: pipe Ø8 OD comp.ends	Air flush of oil gun	A	0	
1069	240-20	1	M0044-001	Non return valve DN100	Material: COR-TEN / AISI 316	Flange DIN PN10	Common for F.G. and T.U.G.	B	0	
1073	220-10	1	M0245-002	Burner gun, no return	Hamworthy Moss	Conn. M18x1,5		A	0	
1074	200-40	1	M0156-001	Ball valve DN15	2013M AISI 316L PN64	Connect: 1/2" BSP		A	0	
1081		1	M0149-001	Fuel oil filter DN25	2.04.5, Ident-Nr.0228422	Flange: DIN PN16		A	0	

Order No: **130959** FG10000-16 (8600-13590 Nm3/h)

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
1082		1	M1303-001	Fuel oil pump without motor	E4 NA-1001 6P			A	2	
1083		1	M2372-001	El. motor	M2AA 80 A			A	2	
1084	220-10	1	N9345-001	Flexible oil hose, 3/8"	Dunlop Hiflex 122 (EN853 1SN)	Connect: M18x1,5 L=1m	Fuel oil to main burner	A	2	
1085		1	N9341-001	Flexible oil hose, 1/4"	Dunlop Hiflex 122 (EN853 1SN)	Connect: M16x1,5 L=1m	Fuel oil to ignition burner	A	2	
1086		1	M1361-001	Oil nozzle, main burner	60° - 7,5 USG/H			A	2	
1087		1	M0106-002	Ignition burner	Hamworthy Moss			A	10	
1088		1	M0105-002	Oil nozzle, ignition burner	Type F80, 1 GPH - 80°R	Connect: 9/16" 24 UNEF		A	0	
1089		1	M3586-001	Ignition glow plug 12V	Type GH 408	Connection M14 x 1,25		A	0	
1090		2	M0231-001	Sight Glass	Hamworthy Moss			A	10	
1107	210-40	1	M5904-002	Blower DN100	L45/2P	DIN PN 10		A	2	
1109		1	N8794-001	El. motor	M3AA 132 SC2			A	2	
1110		1	M5905-001	Blower DN100 assembly	LRB45/2P	Flange: JIS 5K		B	12	
1114	220-10	1	M0239-001s	Sight glass DN400	NS 6141/ISO 1751-A400-LW	Connect: welding type, DN400		A	0	
1117		6	M1366-001s	Sea water spray nozzle	Moss-1-90-4, 90°	Connect.: 1" BSP		A	2	
1123	0-0	1	M1011-128	Sea water pump	Supply to Scrubber				99	
1124		1	M1011-129	El. motor	For Scrubber sea water pump				99	
1130	220-10	1	M1331-001	Wet filter for scrubber	692x206x200			A	2	
1131		1	M1314-001	Demister for scrubber	692x554x150			A	2	
1152		1	N3296-002	Solenoid valve 2/2-way NC air	SCE272A017MSS3 24V DC 15bar	1/4" BSP Material: Brass	Air to ignition burner, 24V, 60 Hz	A	0	
1153	200-40	1	N8726-001	3-way ball valve DN15	F138	Connect: 1/2" BSP		A	2	
		1	N8727-001	3 way Ball valve, DN 15	F138, DN15, Full Bore	Connect: 1/2" BSP		A	2	
		1	N9365-001	Pneumatic actuator	PRA-002			A	2	
		1	N1068-001	Solenoid valve 5/2	791/B 24V DC	Connect: 1/4" BSP		A	2	

Order No: **130959** FG10000-16 (8600-13590 Nm3/h)

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
1156	220-10	1	N3296-002	Solenoid valve 2/2-way NC air	SCE272A017MSS3 24V DC 15bar	1/4" BSP Material: Brass	Fuel oil to burner, 24 V, 60 Hz	A	0	
1157		1	N3296-002	Solenoid valve 2/2-way NC air	SCE272A017MSS3 24V DC 15bar	1/4" BSP Material: Brass	Air flush of oil gun, 24 V, 60 Hz	A	0	
1158		1	N3297-003	Solenoid valve 2/2-way NC oil	SCE272A046MS 24V DC	1/4" BSP Material: AISI316L	Fuel oil to ignition burner, 24 V, 60 Hz	A	0	
1161		1	M0115-001	Pressure gauge, dia. 63mm	Scale 0-1 bar / 0-100 kPa	Connect: 1/4" BSP AISI 316	Combustion air to burner	A	0	
1162		1	M0115-001	Pressure gauge, dia. 63mm	Scale 0-1 bar / 0-100 kPa	Connect: 1/4" BSP AISI 316	Seawater to cooling jacket	A	0	
1164		1	M0117-001	Pressure gauge, dia. 63mm	Scale 0-4 bar / 0-400 kPa	Connect: 1/4" BSP AISI 316	Seawater main inlet to scrubber	A	0	
1165		1	M0119-001	Pressure gauge, dia. 63mm	Scale 0-40 bar / 0-4 MPa	Connect: 1/4" BSP AISI 316	Fuel oil to burner	A	0	
1175		1	M0124-001	Thermometer 0-100°C	Straight type, L=63mm	Connect: 1/2" BSP	Seawater main inlet to scrubber	A	0	
1178		1	M0124-001	Thermometer 0-100°C	Straight type, L=63mm	Connect: 1/2" BSP	Seawater outlet cooling jacket	A	0	
1179		1	M0124-001	Thermometer 0-100°C	Straight type, L=63mm	Connect: 1/2" BSP	Inert Gas outlet scrubber	A	0	
1180		1	M0168-001	Pressure switch -1/+1,25 bar	D2T-M18SS-Exi			A	0	
1184		1	M0169-001	Pressure switch 0.1-2.1 bar	P1H-B30-SS	Connect: 1/4" NPT		A	0	
1185		1	M0166-001	Pressure switch 6.89-23.44 bar	4140C K1E13 AAO-EE	Connect: 1/4" BSP		A	0	
1191		1	M0181-001	Level switch	Type 003S	Connect: 1" BSP		A	0	
1193		1	M0181-001	Level switch	Type 003S	Connect: 1" BSP	High sea water level Scrubber	A	0	
1200		2	M0086-001	Photocell complete	Hamworthy Moss		Burner flame scanner	A	10	
1202	200-40	1	M0339-001	Flow indicator 0-100kg/h	Model 10A1197ASS	Connect: 1/2" BSP		A	0	
1209	220-10	1	M0094-002	Ignition Transformer	234VA 115-220	9-13V 50/60HZ	For glow plug	A	2	
1220		1	M0112-001	Pressure transmitter	Type 8161-1221-1111	0-0,3 bar (g)		A	0	
1229	200-40	1	M1295-000	Fuel Oil Unit	TG			B	12	
1241	230-10	1	M1725-001	Starter T.U.G Blower	DOL- max. 9kW 14.5A			B	2	

Order No: **130959** FG10000-16 (8600-13590 Nm3/h)

Item	SO No	Qty	Article No	Description	Specification	Remark	Notes	Supply	Stk Type	Packing No
1243	230-20	1	M1681-001	Starter fuel oil pump	Max. 5kW 12A			B	2	
1253	220-10	1	M1248-001	Burner / Scrubber unit	GP - Nom. size: 500Nm3/h-7	Incl. pneumatic panel		A	2	
1901	260-10	1	M1361-001	Oil nozzle, main burner	60° - 7,5 USG/H		Spare	B	2	
1902	260-20	1	M0105-002	Oil nozzle, ignition burner	Type F80, 1 GPH - 80°R	Connect: 9/16" 24 UNEF	Spare	B	0	
1903	260-30	1	N9345-001	Flexible oil hose, 3/8"	Dunlop Hiflex 122 (EN853 1SN)	Connect: M18x1,5 L=1m	Spare	B	2	
1904	260-40	1	N9341-001	Flexible oil hose, 1/4"	Dunlop Hiflex 122 (EN853 1SN)	Connect: M16x1,5 L=1m	Spare	B	2	
1905	260-50	1	M0150-001	Insert for fuel oil filter	Basket element - 250 mikron		Spare	B	0	
1907	260-60	1	M3586-001	Ignition glow plug 12V	Type GH 408	Connection M14 x 1,25	Spare	B	0	
1931	260-70	1	M1952-001	Ball bearing	6208-2Z/C3		Spare	B	2	
1932	260-80	1	M1952-001	Ball bearing	6208-2Z/C3		Spare	B	2	
1933	260-90	1	M1443-001	Ball bearing	6204-2Z/C3		Spare	B	2	
1934	260-100	1	M2597-001	Ball bearing	6203-2Z/C3		Spare	B	2	

INDICATING INSTRUMENTS

- (SG) SIGHT GLASS
- (FI) FLOW INDICATOR
- (TI) TEMPERATURE INDICATOR
- (PI) PRESSURE/VACUUM INDICATOR
- (LI) LEVEL INDICATOR
- (ZI) POSITION INDICATOR
- (AI) ANALYSE INDICATOR O_2-CONTENT
- (MI) MOISTURE INDICATOR
- (AIR) ANALYSE INDICATING RECORDER
- (PIR) PRESSURE INDICATING RECORDER
- (PdI) DIFFERENTIAL PRESSURE INDICATOR
- (VI) VIBRATION INDICATOR

ALARMS

- (PsAh) PRESSURE SHUT DOWN ALARM HIGH
- (PsAl) PRESSURE SHUT DOWN ALARM LOW
- (PAh) PRESSURE ALARM HIGH
- (PAhh) PRESSURE ALARM VERY HIGH
- (PAl) PRESSURE ALARM LOW
- (PAll) PRESS. ALARM VERY LOW
- (TsAh) TEMP. SHUT DOWN ALARM HIGH
- (LsAh) LEVEL SHUT DOWN ALARM HIGH
- (LsAl) LEVEL SHUT DOWN ALARM LOW
- (AAh) ANALYSE O_2-ALARM HIGH
- (AAl) ANALYSE O_2-ALARM LOW
- (BsA) BURNER FLAME SHUT DOWN ALARM
- (FAl) FLOW FAILURE O_2-SAMPLE
- (FsAl) FLOW SHUT DOWN ALARM LOW
- (IsAl) BLOWER FAILURE SHUT DOWN
- (MAh) MOISTURE ALARM HIGH
- (PdAh) DIFFERENTIAL PRESSURE ALARM HIGH
- (YA) COMMON ALARM
- (XA) OXYGEN SENSOR FAILURE
- (VAh) VIBRATION ALARM HIGH

SWITCHES

- (PS) PRESSURE SWITCH
- (TS) TEMPERATURE SWITCH
- (LS) LEVEL SWITCH
- (FS) FLOW SWITCH
- (IS) CURRENT SWITCH
- (AS) ANALYSE SWITCH
- (MS) MOISTURE SWITCH
- (PdS) DIFFERENTIAL PRESSURE SWITCH

VALVE TYPE

- 4-WAY VALVE
- 3-WAY VALVE
- SHUT OFF VALVE
- CONTROL VALVE
- NON-RETURN VALVE (CV)
- SWING CHECK VALVE (SWCV)
- BUTTERFLY VALVE (BFV)
- REDUCTION VALVE (RDV)
- BALL VALVE
- SAFETY VALVE
- VACUUM VALVE
- SPECTACLE FLANGE
- SINK
- VACUUM/RELIEF VALVE
- ORIFICE

VALVE OPERATION

- MANUAL
- (S) SOLENOID
- CYLINDER
- SPRING CLOSE
- SPRING OPEN
- (VP) VALVE POSITIONER
- PRESSURE ACTUATED MODULATING
- DIAPHRAGM.

SIGNALS

- PNEUMATIC
- PROCESS (PIPE)
- ELECTRICAL

OTHERS

- BLOWER (ROOTS)
- BLOWER (CENTR. FAN)
- COMPRESSOR
- PUMP
- HEATER
- CYCLONE
- COOLER
- IGN. TRANSFORMER
- (M) EL. MOTOR
- (AE) ANALYSER
- (BE) BURNER FLAME SCANNER
- (AT) ANALYSE TRANSMITTER
- (PIC) P + I CONTROLLER
- (LC) LEVEL CONTROL
- (TC) TEMPERATURE CONTROL
- (HIC) HAND OPERATED INDICATING CONTROLLER
- (PY) I/P CONVERTER
- (PT) PRESSURE TRANSMITTER
- (TT) TEMPERATURE TRANSMITTER
- (IY) INTRINSIC SAFE RELAY
- (VE) VIBRATION SENSOR
- (VC) VIBRATION CONTROLLER
- AUTOMATIC DRAINER
- FILTER
- FLAME ARRESTOR
- SILENCER
- FLEX. CONNECTION
- FLEX. HOSE
- LIMIT SWITCH, OPEN POSITION
- LIMIT SWITCH, CLOSED POSITION
- QUICK COUPLING

Forandringer: REV 00) 19990521/SKG 01) 20070914/ VALVE OPERATION UPDATED

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
MOSS STANDARD			BT			19990521	1:1	9000

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

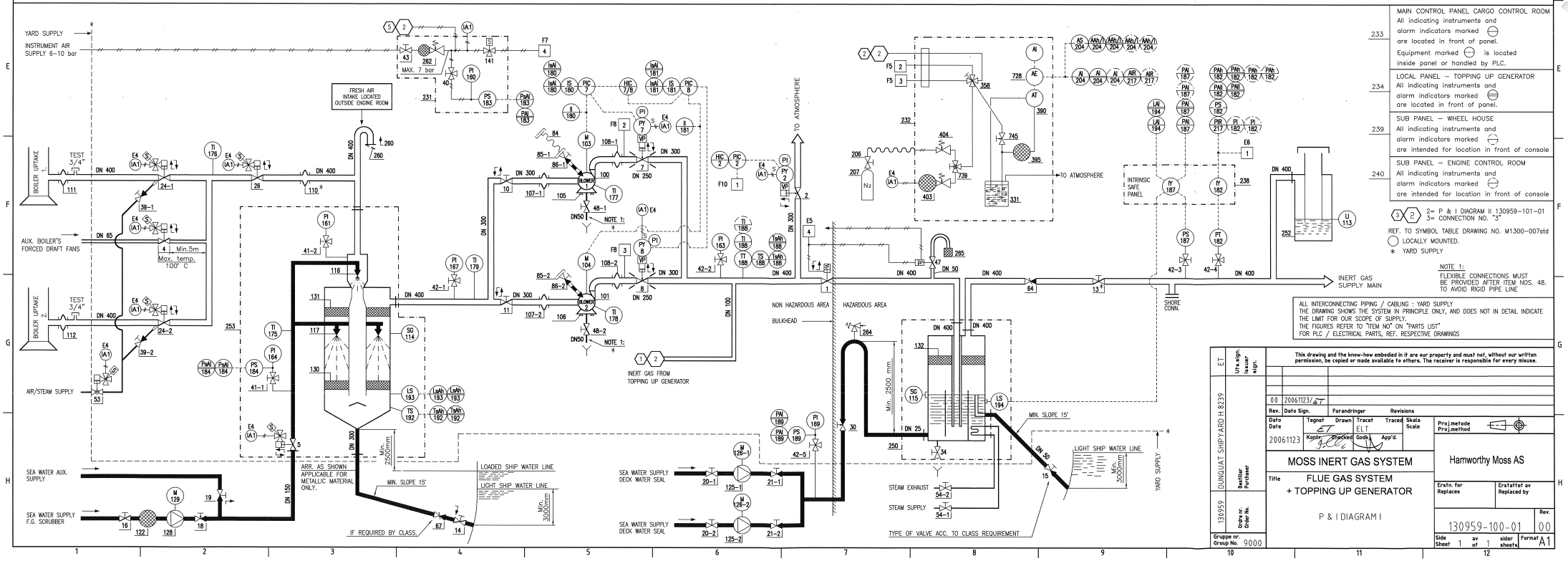
Title

MOSS SYMBOL TABLE
SUPPLY EQUIPMENT

Erstn. for Replacec	Erstattet av Replaced by
A4-7448	

M1300-007std — Rev. 01

Side / Sheet 1 av / of 1 sider / sheets — Format A4



MAIN CONTROL PANEL CARGO CONTROL ROOM
All indicating instruments and alarm indicators marked ⊖ are located in front of panel.
Equipment marked ⊖ is located inside panel or handled by PLC.

233

LOCAL PANEL – TOPPING UP GENERATOR
All indicating instruments and alarm indicators marked ⊖ are located in front of panel.

234

SUB PANEL – WHEEL HOUSE
All indicating instruments and alarm indicators marked ⊖ are intended for location in front of console

239

SUB PANEL – ENGINE CONTROL ROOM
All indicating instruments and alarm indicators marked ⊖ are intended for location in front of console

240

3 2 2= P & I DIAGRAM II 130959-101-01
3= CONNECTION NO. "3"

REF. TO SYMBOL TABLE DRAWING NO. M1300-007std
◯ LOCALLY MOUNTED.
✳ YARD SUPPLY

NOTE 1:
FLEXIBLE CONNECTIONS MUST BE PROVIDED AFTER ITEM NOS. 48, TO AVOID RIGID PIPE LINE

ALL INTERCONNECTING PIPING / CABLING : YARD SUPPLY
THE DRAWING SHOWS THE SYSTEM IN PRINCIPLE ONLY, AND DOES NOT IN DETAIL INDICATE THE LIMIT FOR OUR SCOPE OF SUPPLY.
THE FIGURES REFER TO "ITEM NO" ON "PARTS LIST"
FOR PLC / ELECTRICAL PARTS, REF. RESPECTIVE DRAWINGS

This drawing and the know-how embedded in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.

Ufs.sign. Issuer sign:	ET
Bestiller Purchaser	DUNGUAT SHIPYARD H 8239
Ordre nr. Order No.	130959
Gruppe nr. Group No.	9000

Rev.	Date Sign.	Forandringer Revisions
00	20061123/ET	

Dato Date	Tegnet Drawn	Tracet Traced	Skala Scale
20061123	ET	ELT	
	Kontr. Checked	Godk. App'd.	

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM + TOPPING UP GENERATOR

P & I DIAGRAM I

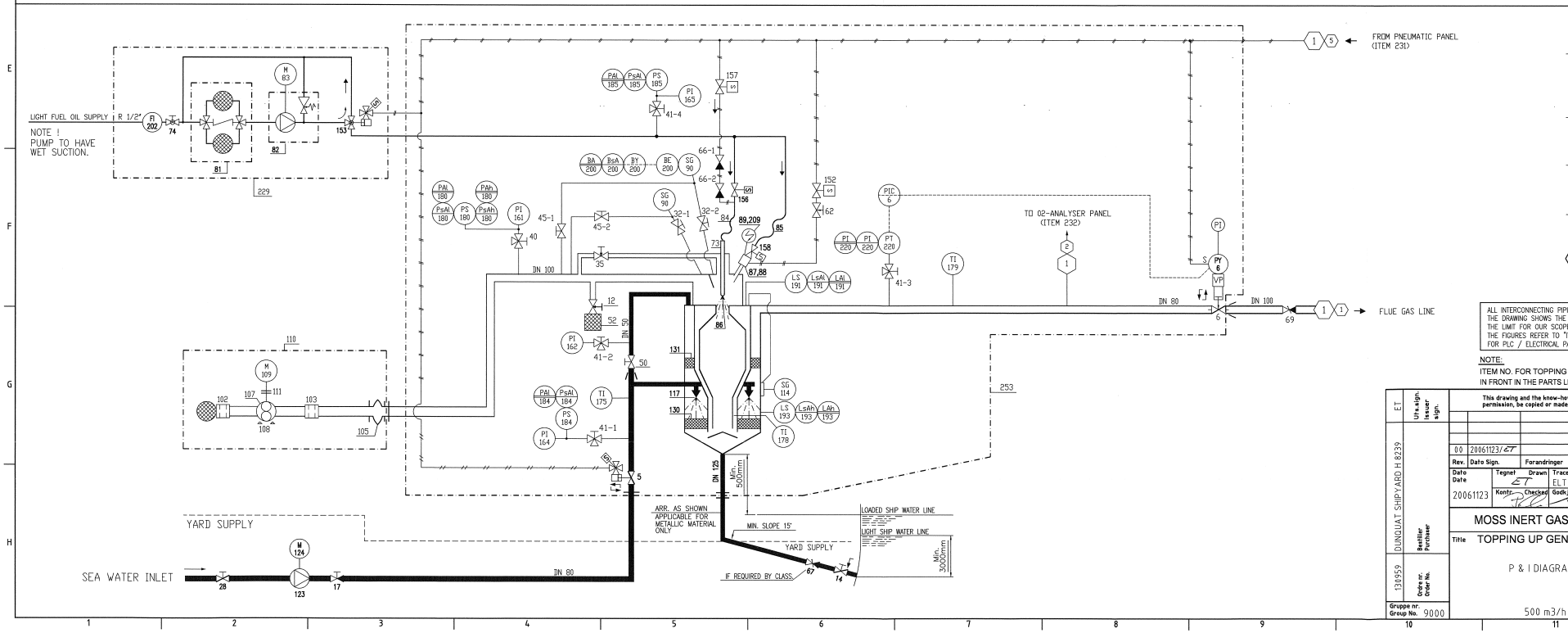
Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

Rev. 00

130959-100-01

Side Sheet 1 av of 1 sider sheets | Format A1



233	MAIN CONTROL PANEL CARGO CONTROL ROOM FLUE GAS + TOPPING UP GENERATOR All indicating instruments and alarm indicators marked ⊖ are located in front of panel. Equipment marked ⊖ is located inside panel or handled by PLC.
234	LOCAL PANEL – TOPPING UP GENERATOR All indicating instruments and alarm indicators marked ⊖ are located in front of panel.
239	INSTRUMENTATION – WHEEL HOUSE All indicating instruments and alarm indicators marked ⊖ are intended for location in front of console
240	INSTRUMENTATION – ENGINE CONTROL ROOM All indicating instruments and alarm indicators marked ⊖ are intended for location in front of console

5 1 1 = P&I DIAGRAM I 130959-100-01
5 = CONNECTION NO. " 5 "
REF. TO SYMBOL TABLE DRAWING NO. M1300-007std
○ LOCALLY MOUNTED.

ALL INTERCONNECTING PIPING / CABLING : YARD SUPPLY
THE DRAWING SHOWS THE SYSTEM IN PRINCIPLE ONLY, AND DOES NOT IN DETAIL INDICATE THE LIMIT FOR OUR SCOPE OF SUPPLY.
THE FIGURES REFER TO "ITEM NO" ON "PARTS LIST"
FOR PLC / ELECTRICAL PARTS, REF. RESPECTIVE DRAWINGS

NOTE:
ITEM NO. FOR TOPPING UP GENERATOR HAS 1000 EXTENSION IN FRONT IN THE PARTS LIST.

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.

Rev.	Date Sign.	Forandringer	Revisions
00	20061123/ET		

Date	Tegnet	Drawn	Tracet	Traced	Skala Scale
20061123	ET		ELT		

Kontr. Checked Godkjt. App'd.

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title TOPPING UP GENERATOR

P & I DIAGRAM II

500 m3/h

Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

130959-101-01 Rev. 00

Side Sheet av of 1 sider sheets Format A1

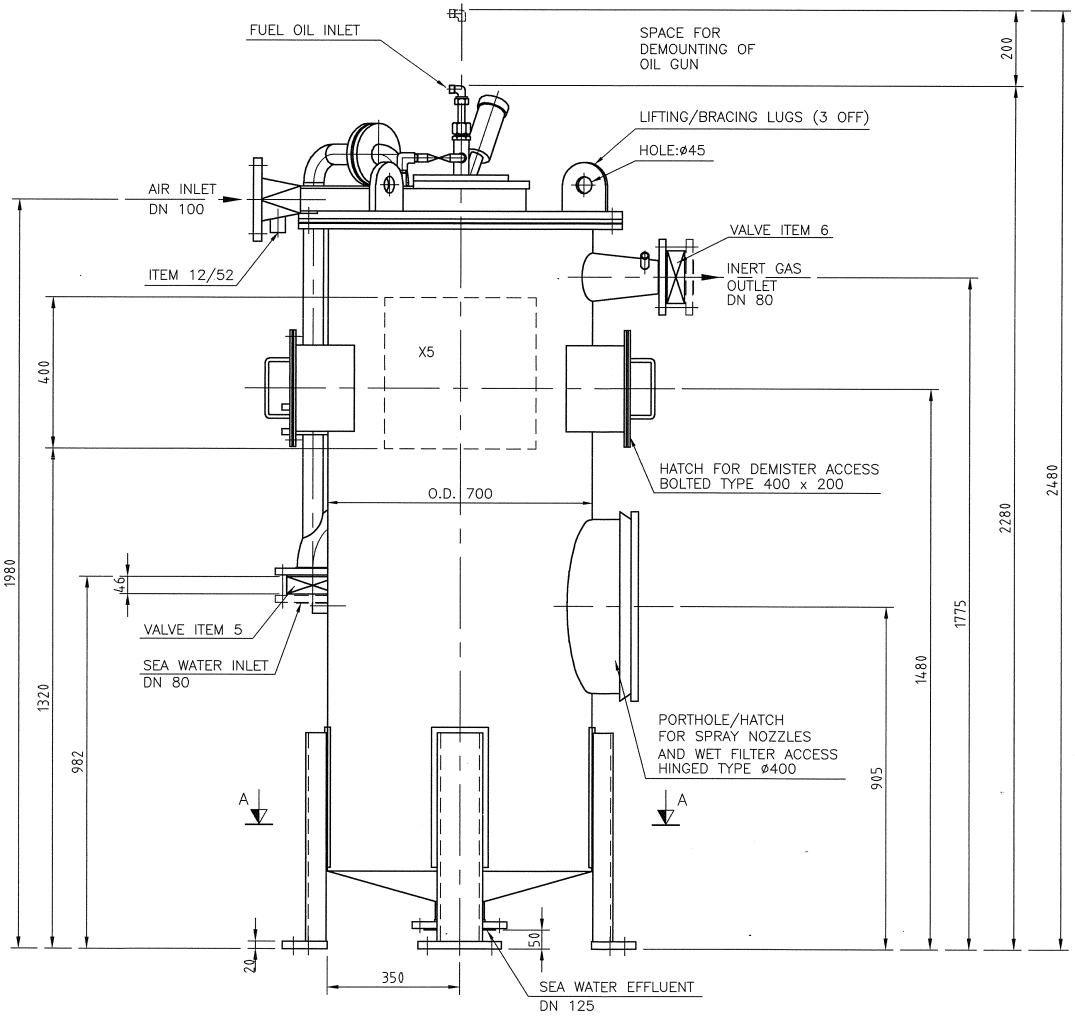
ET Utv.sign. Issuer sign.

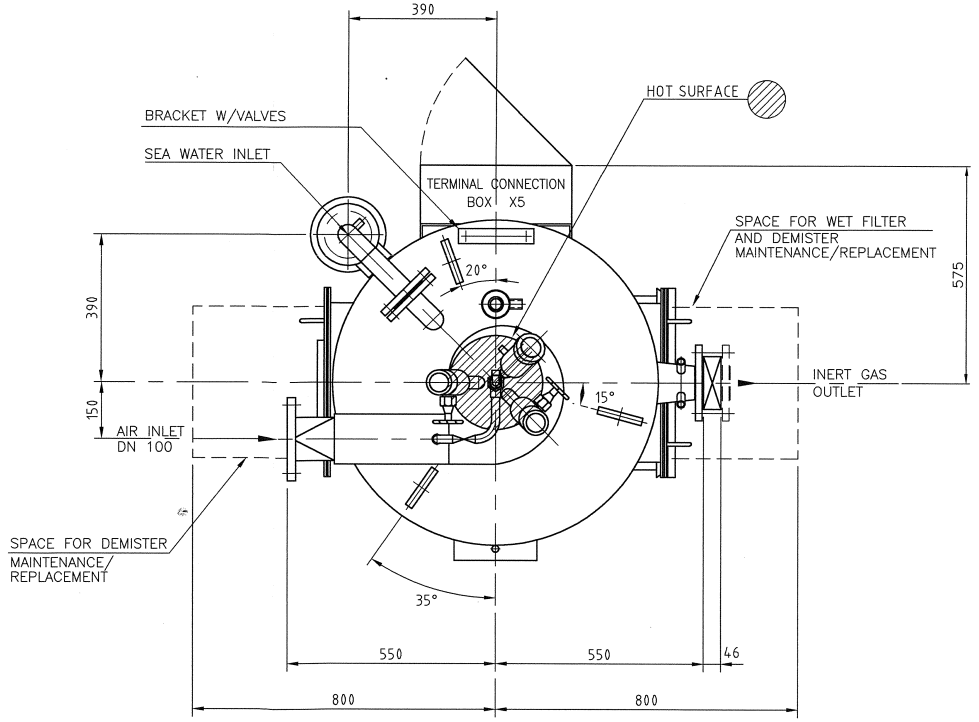
DUNQUAT SHIPYARD H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

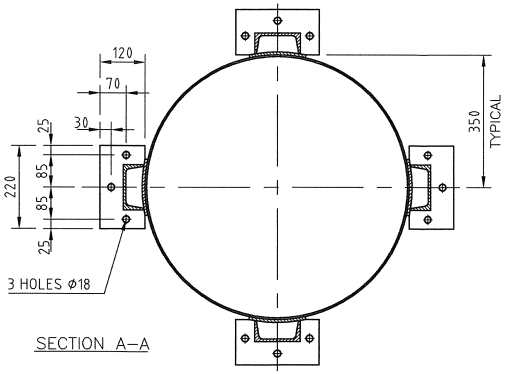
Gruppe nr. Group No. 9000

DESIGN DATA	
DESIGN PRESSURE:	0,3 BAR
LEAKAGE TEST PRESSURE:	0,45 BAR
CLASSIFICATION: ABS	





WEIGHT: APPROX 700 KG



SECTION A–A

NOTES !

APPLICATION ON MILD STEEL.
1 COAT CONSEAL PRIMER TO A TOTAL DRY FILM THICKNESS OF 40 MICRONS.
1 COAT PILOT II TOPCOAT TO A TOTAL DRY FILM THICKNESS OF 50 MICRONS.
01 COLOUR: MUNSELL 7.5 BG 7/2
ALL FLANGE CONNECTIONS IN ACCORDANCE WITH DIN STANDARD PN 10

LADDERS AND SAFETY RAILS RECOMMENDED DURING MAINTENANCE OR REPAIR WORK INVOLVING WORKING HEIGHT ABOVE 2M.
THIS IS NOT PART OF STANDARD DELIVERY.

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.

Rev.	Dato Sign.	Forandringer / Revisions
01	20070418/ET	NEW COLOUR.
00	20061123/ET	

Utf.sign. Issuer sign.: ET
Bestiller Purchaser: DUNQUAT S.Y. H.8239
Ordre nr. Order No.: 130959
Gruppe nr. Group No.: 9000

Dato Date: 20061123 | Tegnet Drawn: ET | Tracet Traced: MAA | Skala Scale: 1:10
Kontr. Checked | Godkj. App'd.
Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title: TOPPING UP GENERATOR
BURNER/SCRUBBER UNIT
ARRANGEMENT
ITEM 253

SIZE: 500 m3/h

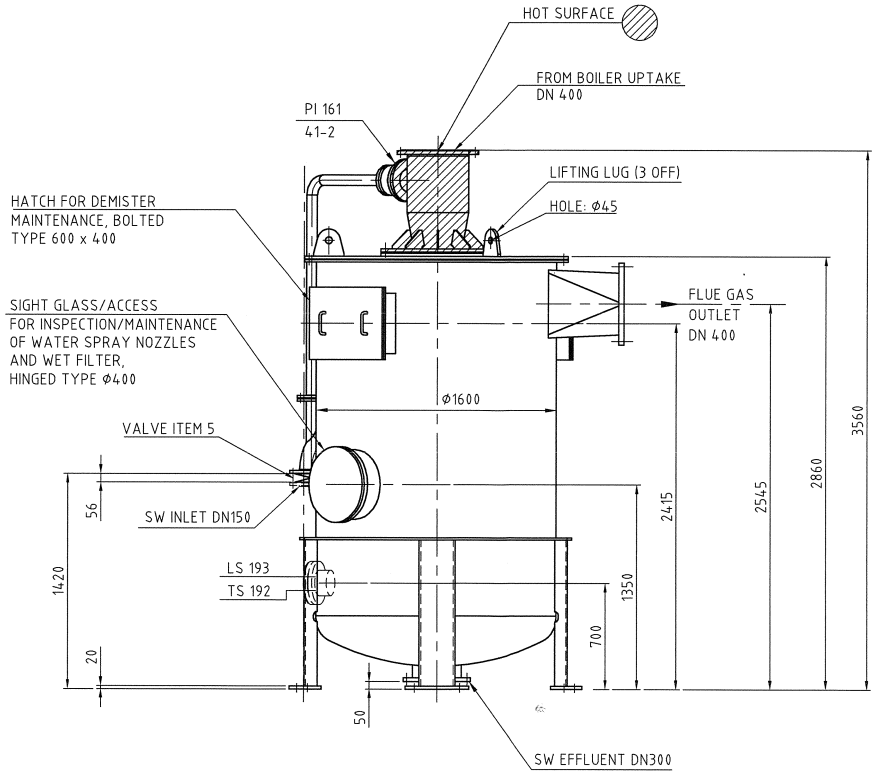
Hamworthy Moss AS

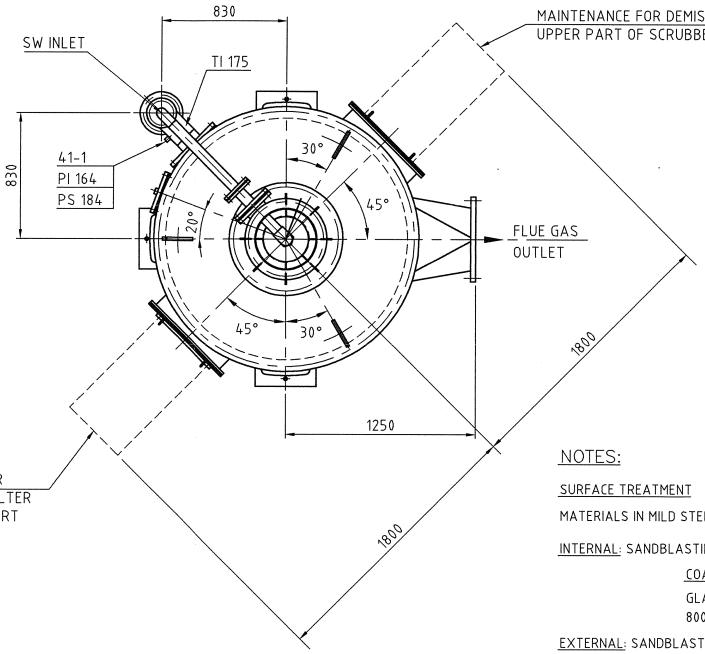
Erstn. for Replaces | Erstattet av Replaced by

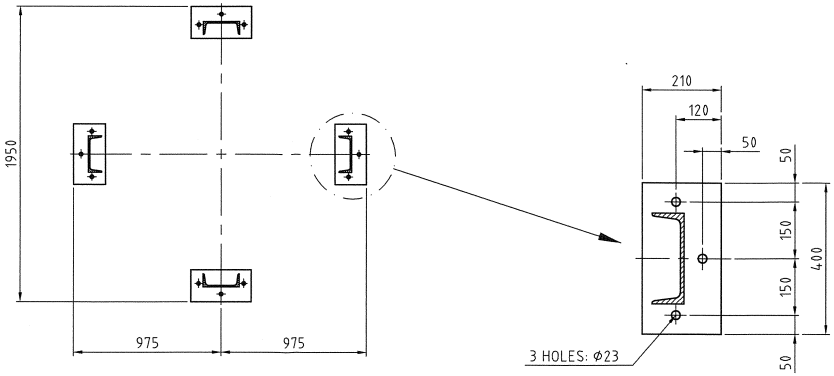
130959-050-01 | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A2

DESIGN DATA
LEAKAGE TEST PRESSURE: 2500 mm WG
CLASSIFICATION: ABS







FOUNDATION PLAN

NOTES:

SURFACE TREATMENT

MATERIALS IN MILD STEEL:

INTERNAL: SANDBLASTING TO SA 2,5

COATING:

GLASS REINFORCED POLYESTER (GRP):
800 - 1000 MICRONS

EXTERNAL: SANDBLASTING TO SA 2,5

COATING:

1 COAT TWO PACK EPOXY: 75 MICRONS
1 COAT ALKYD TOP COAT: 50 MICRONS

01 COLOUR: MUNSELL 7.5 BG 7/2

ALL FLANGE CONNECTIONS IN ACCORDANCE
WITH DIN STANDARD PN10

LADDERS AND SAFETY RAILS RECOMMENDED
DURING MAINTENANCE OR REPAIR WORK INVOLVING
WORKING HEIGHT ABOVE 2M.
THIS IS NOT PART OF STANDARD DELIVERY.

DRY WEIGHT: APPROX. 2200 Kg

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Rev.	Dato Sign.	Forandringer Revisions
01	20070418/ET	NEW COLOUR.
00	20061123/ET	

Dato Date	Tegnet Drawn	Tracet Traced	Skala Scale
20061123	ET	MAA	1:25
	Kontr. Checked	Godkj. App'd.	

Proj.metode Proj.method

DUNQUAT S.Y. H.8239 — Bestiller Purchaser — Ut's.sign. Issuer sign. ET

130959 — Ordre nr. Order No.

Gruppe nr. Group No. 9000

MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM
SCRUBBER UNIT
ARRANGEMENT
ITEM 253

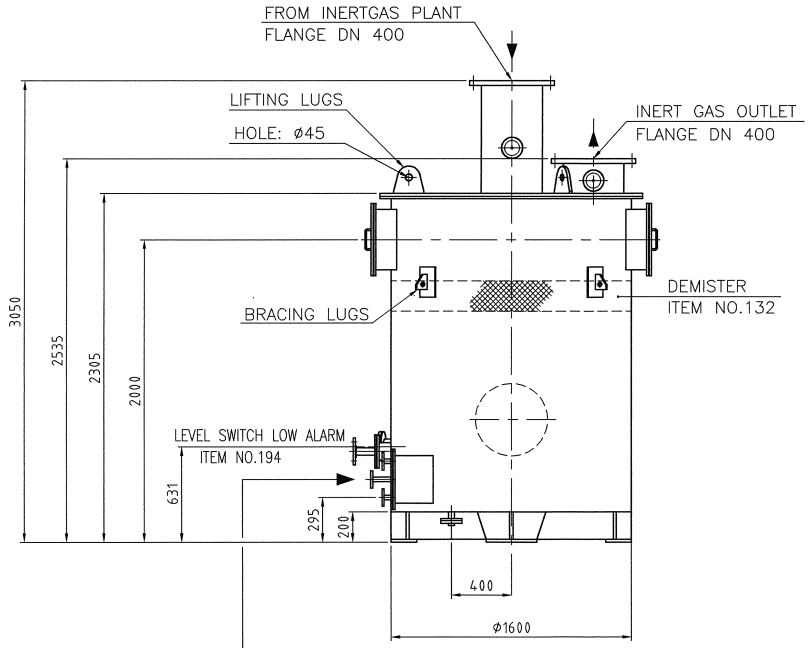
SIZE: 9.400 m3/h

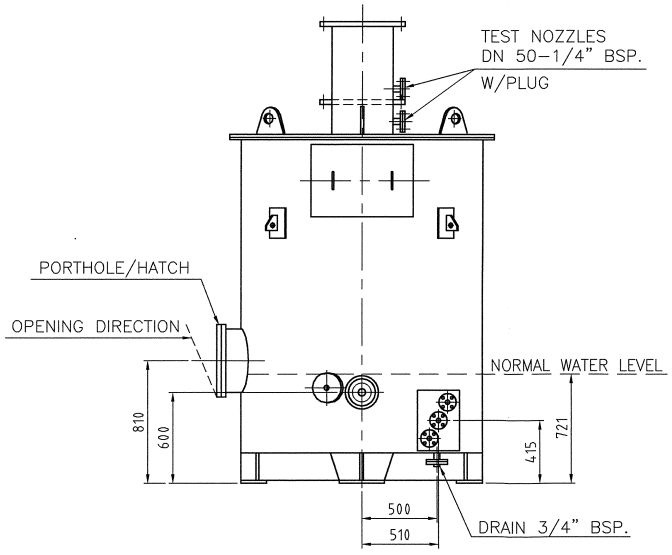
Hamworthy Moss AS

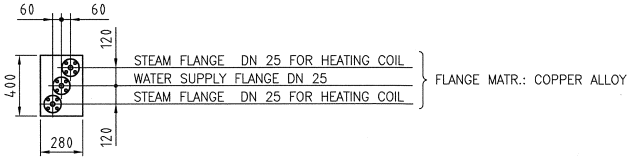
Erstn. for Replaces | Erstattet av Replaced by

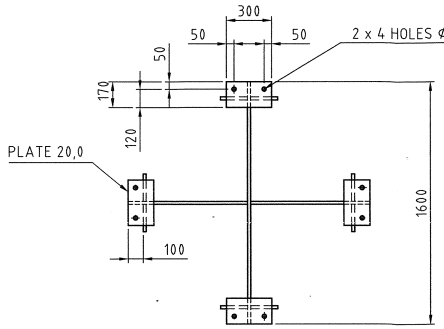
130959-051-01 | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A2

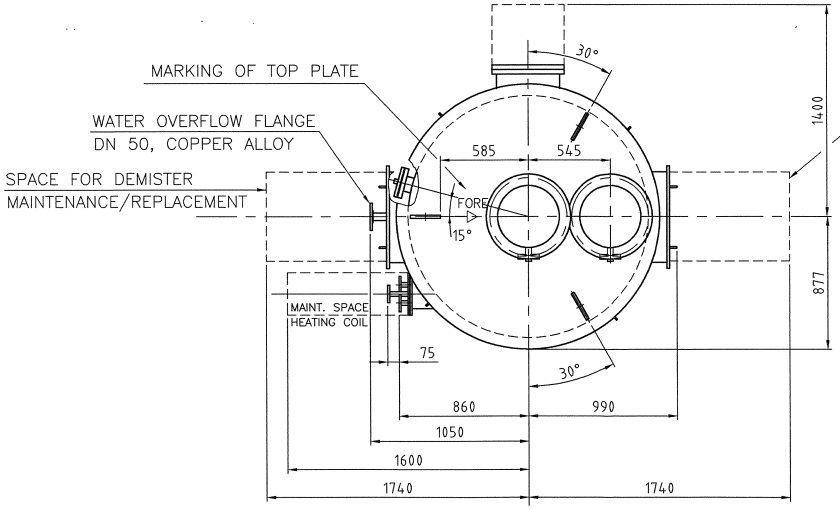








BOLT PLAN



SPACE FOR DEMISTER
MAINTENANCE/REPLACEMENT

LONGITUDINAL DIRECTION

NOTE: DECK WATER SEAL INLET/OUTLET
TO BE LOCATED AS INDICATED BY ARROW.
SWING CHECK VALVE DOWNSTREAM
DECK WATER SEAL TO BE ARRANGED
IN SHIP'S LONGITUDINAL DIRECTION.

DESIGN DATA
DESIGN PRESSURE: 2500 mm W.G.
LEAKAGE TEST PRESSURE: 0,4 BAR
CLASSIFICATION: ABS

NOTES:

THE SEAL IS DESIGNED TO OPERATE SATISFACTORY UNDER THE FOLLOWING CONDITIONS:

ANGLE OF INCLINATION:

ATHWARTS SHIPS: STATIC 15°
DYNAMIC 22,5°

FORE–AND–AFT: STATIC 5°
DYNAMIC 7,5°

SURFACE TREATMENT:

INTERNAL:
SANDBLASTING TO SA 2,5

COATING:
1 COAT GLASS REINFORCED POLYESTER (GRP) TO 1000–1200 MICRONS
SPARK TESTING OF INTERNAL COATING: MAX. 1500 V.

EXTERNAL:
SANDBLASTING TO SA 2,5.

COATING:
1 COAT TWO PACK EPOXY: 75 MICRONS
1 COAT TWO COMPONENT EPOXY: 150 MICRONS
1 COAT TWO PACK EPOXY TOP COAT: 50 MICRONS
02 COLOUR: MUNSELL 10R 5.5 / 14.5

ALL FLANGE CONNECTIONS IN ACCORDANCE WITH DIN STANDARD PN10

LADDERS AND SAFETY RAILS RECOMMENDED DURING MAINTENANCE OR REPAIR WORK INVOLVING WORKING HEIGHT ABOVE 2M.
THIS IS NOT PART OF STANDARD DELIVERY.

WEIGHT APPROX: DRY. 2300 KG
OPER. 3100 KG

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Rev.	Dato Sign.	Forandringer Revisions
02	20070601/ET	COLOUR CORRECTED.
01	20070418/ET	NEW COLOUR.
00	20061123/ET	

Uts.sign. issuer sign.: ET

Dato Date: 20061123 | Tegnet Drawn: ET | Tracet Traced: MAA | Skala Scale: 1:25 | Kontr. Checked: ØF | Godkj. App'd.: KNU

Proj.metode Proj.method

DUNQUAT S.Y. H. 8239 — Bestiller Purchaser

130959 — Ordre nr. Order No.

Gruppe nr. Group No. 9000

MOSS INERT GAS SYSTEM

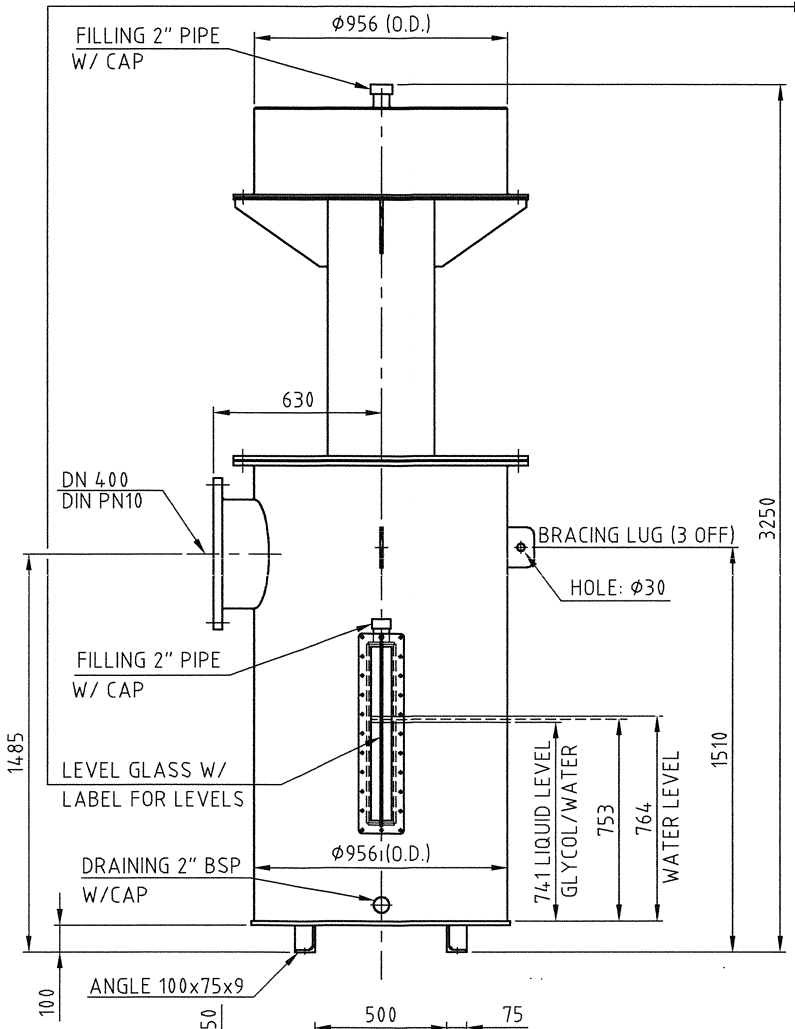
Title: INERT GAS GENERATOR
DECK WATER SEAL
SEALING HEIGHT 2500mm
ARRANGEMENT
ITEM 250
SIZE: 9.400 m3/h

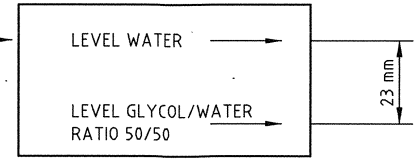
Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

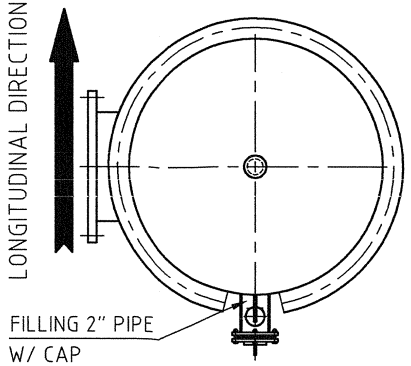
130959-052-01 | Rev. 02

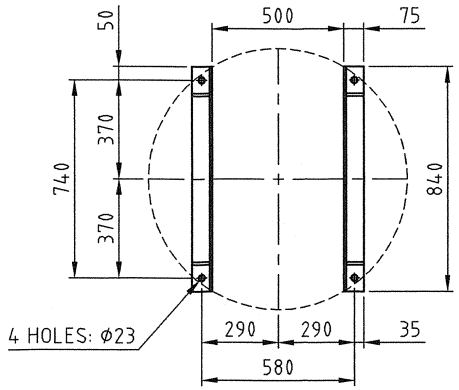
Side Sheet 1 av of 1 sider sheets | Format A2





DETAIL: LEVEL INDICATIONS.





FOUNDATION PLAN

LEAKAGE TEST PRESSURE : 0,4 BAR
CLASSIFICATION: ABS
WEIGHT APPROX: DRY 900 KG.

DESIGN DATA: BY 30° ROLL	IN VERTICAL POSITION
PRESSURE: 2078 MM WG	2400 MM WG
VACUUM: 433 MM WG	500 MM WG

LIQUID FILLING OF P/V - BREAKER	
WATER	: 529 Litre
GLYCOL / WATER (50 / 50)	: 514 Litre

NOTES:

SURFACE TREATMENT:
INTERNAL:
SANDBLASTING TO SA 2,5

COATING:
1 COAT TWO PACK MODIFIED EPOXY: 300 MICRONS

EXTERNAL:
SANDBLASTING TO SA 2,5

COATING:
1 COAT TWO PACK EPOXY: 75 MICRONS
1 COAT TWO COMPONENT EPOXY: 150 MICRONS
1 COAT TWO PACK EPOXY TOP COAT: 50 MICRONS
03 COLOUR: MUNSELL 10R 5.5 / 14.5

THE P/V-BREAKER IS PREFERABLY TO BE LOCATED IN THE MIDDLE OF THE DISTANCE BETWEEN THE FORWARD-/OUTMOST TANK SECTION

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Rev.	Dato Sign.	Forandringer
03	20070601/ ET	COLOUR CORRECTED.
02	20070418/ET	NEW COLOUR.
01	20070207/ET	HEIGHT OF PV BREAKER CORRECTED FROM 3186 TO 3250.
00	20061123/ET	

Uts.sign. Issuer sign.	Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
ET	9000	20061123	ET	MAA		KNO	1:20

Bestiller Purchaser: DUNQUAT S.Y. H. 8239
Ordre nr. Order No.: 130959
Proj.metode Proj.method
Hamworthy Moss AS

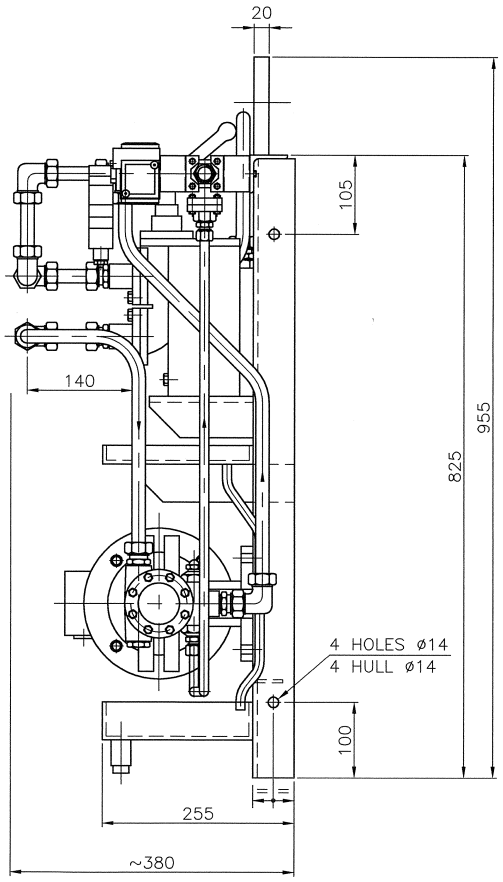
MOSS INERT GAS SYSTEM

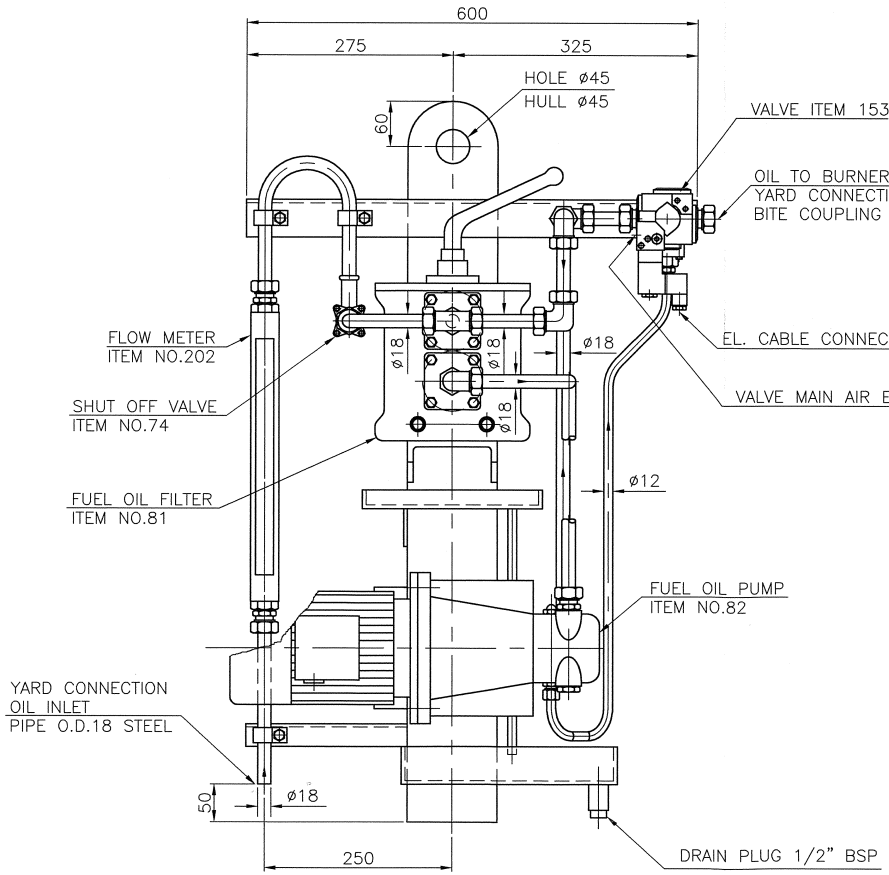
Title: INERT GAS SYSTEM
PRESSURE/VACUUM BREAKER
ARRANGEMENT
ITEM 252
DN 400

Erstn. for Replaces
Erstattet av Replaced by

130959-053-01 Rev. 03

Side Sheet 1 av of 1 sider sheets | Format A3





NOTES !

PUMP TO HAVE WET SUCTION
ITEM NO. REFER TO PART LIST
MAX. DISCHARGE PRESSURE: 30 BAR

PIPES:
ø18 x 2,0 St. 52,4 DIN 2319C/DIN 2445
ø12 x 2,0 St. 37,4 DIN 2545

COLOUR: AS SCRUBBER UNIT

WEIGHT: APPROX 70 Kg

FOR FOUNDATION, SEE DRAWING NO. M1295-001std

SKG | Utsign. Issuer sign.

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Rev.	Dato Sign.	Forandringer Revisions
01	20050817/	TXT. RE. PIPE DIMENSIONS CORR.
00	20001130/SKG	

Dato Date	Tegnet Drawn	Tracet Traced	Skala Scale
20001130	Kontr. Checked	Godkj. App'd.	1:5

MOSS STANDARD | Bestiller Purchaser | Ordre nr. Order No. | Gruppe nr. Group No. 9000

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
FUEL OIL PUMP UNIT
ARRANGEMENT
ITEM 229

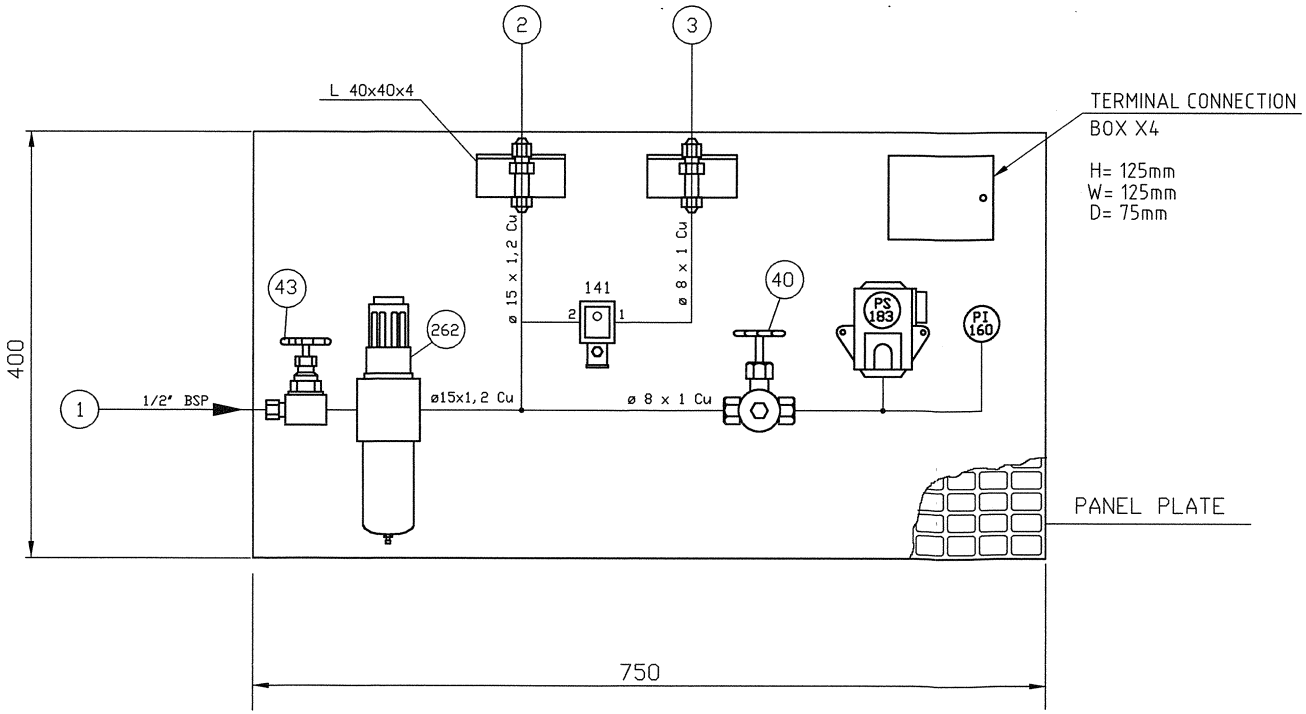
Proj.metode Proj.method

Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

M1295-000std | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A2



NOTE !

EACH CONNECTION WILL BE MARKED AND DELIVERED WITH COUNTER CONNECTION.

EL. CONN. FOR ITEM 141 AND 183 ON INSTRUMENTS.

REF.: CUSTOMERS PNEUMATIC CONNECTIONS

1 AIR SUPPLY

2 AIR TO I.G. SYSTEM CONSUMER

3 AIR TO VALVE ITEM 1 & 47

( ) ITEM NO. -REF. PARTS LIST.

LOCATION OF THIS PANEL:

CLOSE TO OXYGEN ANALYSER PANEL
ITEM NO. 232

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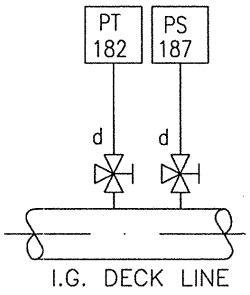
Utf.sign. Issuer sign.	ET								
Bestiller Purchaser	DUNQUAT SHIPYARD H 8239								
Ordre nr. Order No.	130959								
		00	20061123/ ET						
		Rev.	Dato Sign.	Forandringer					
		Gruppe nr. Group No. 6400		Dato Date 20061123	Tegnet Drawn ET	Tracet Traced ELT	Kontr. Checked	Godkj. App'd. KNU	Skala Scale 1:5
		Proj.metode Proj.method		MOSS FLUE GAS SYSTEM				Erstn. for Replaces	Erstattet av Replaced by
		Hamworthy Moss AS		Title PNEUMATIC PANEL ITEM NO. 231				130959-059-01	Rev. 00
								Side Sheet 1 av of 1 sider sheets	Format A3

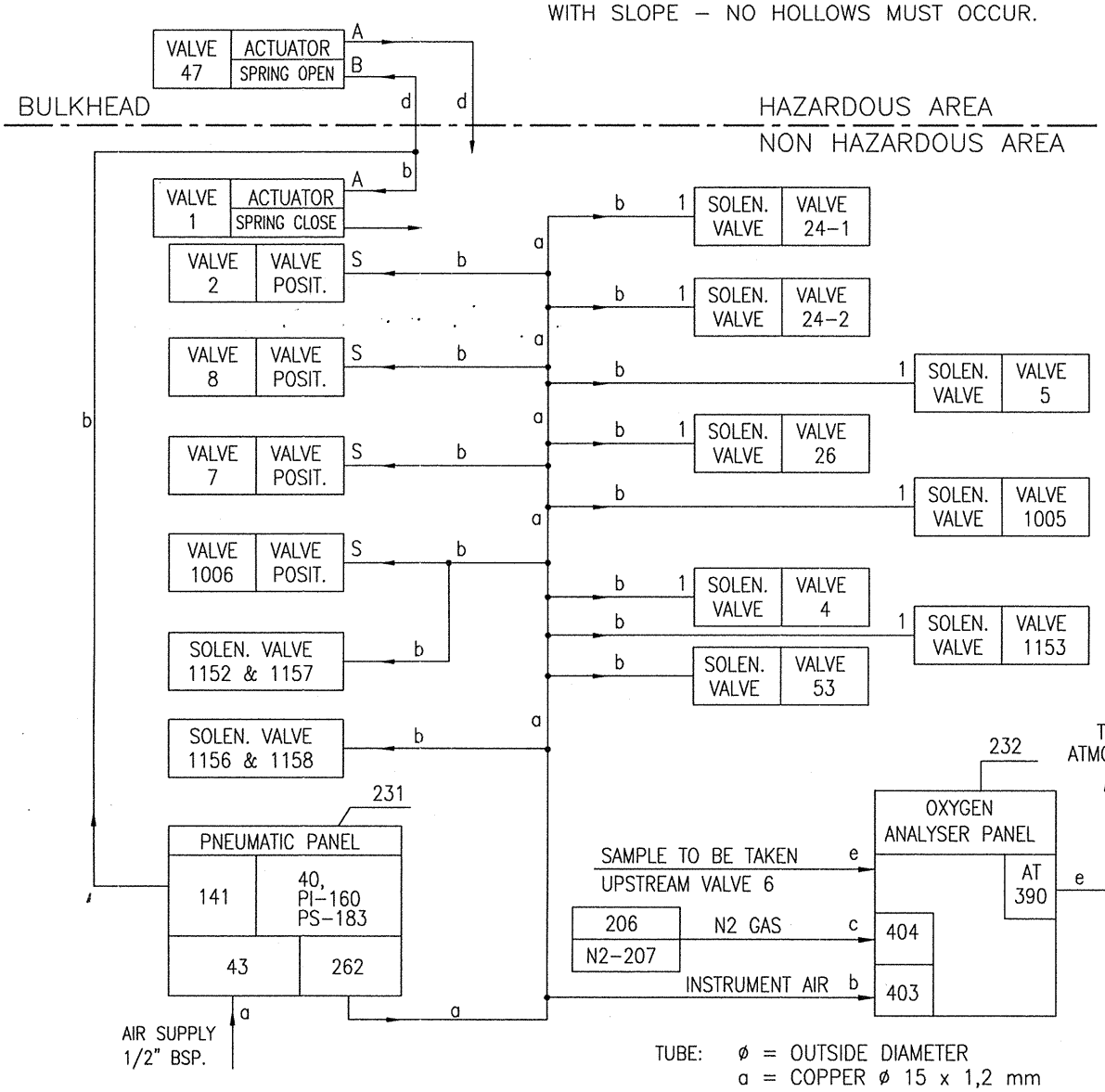
This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.

NOTE: (ITEM PT–182, PS–187)
TO BE LOCATED IN HAZARDOUS AREA – E.G. PUMP ROOM CASING.
OPEN DECK INSTALLATION ADDITIONAL ENCLOSURE TO BE PROVIDED BY YARD.

PROCESS CONNECTION TUBES MUST BE MADE WITH SLOPES. NO HOLLOWS MUST OCCUR.

NOTE: (ITEM 232)
THE DISTANCE OF SAMPLE TUBE TAKEN BEFORE VALVE ITEM 6, 7, AND 8 TO OXYGEN ANALYSER PANEL ITEM 232 TO BE AS SHORT AS POSSIBLE ARRANGED WITH SLOPE – NO HOLLOWS MUST OCCUR.





TUBE: ø = OUTSIDE DIAMETER
a = COPPER ø 15 x 1,2 mm
b = COPPER ø 8 x 1,2 mm
c = PLASTIC ø 8 x 1,0 mm
d = ACID RESIST STEEL ø 8 x 1,0 mm
e = ACID RESIST STEEL ø 6 x 1,0 mm

Bygg nr. / Yard No	Ordre nr. / Order No.	Tegn. / Drawn	Tracet / Traced	Kontr. / Checked	Godkj. / App'd.	Dato / Date	Skala / Scale	Gruppe nr. / Group. No.
DUNQUAT SHIPYARD H 8239	130959	ET	ELT			20061123		6400

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title

FLUE GAS SYSTEM + TOPPING UP GENERATOR

CUSTOMERS PNEUMATIC CONNECTIONS

Erstn. for Replacec	Erstattet av Replaced by

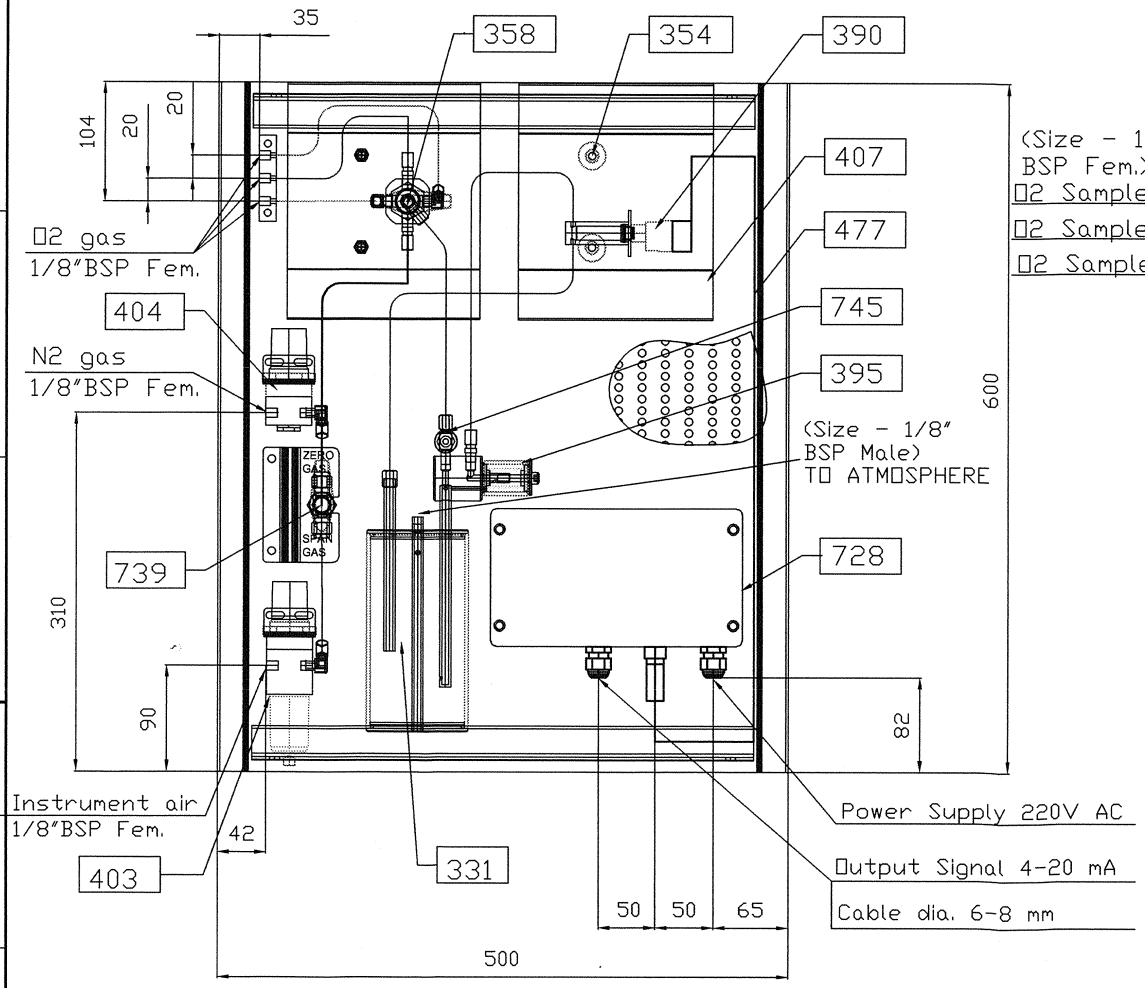
Rev.	Format
00	A4

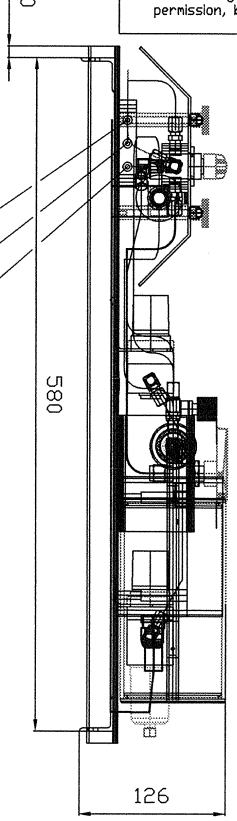
130959-081-01

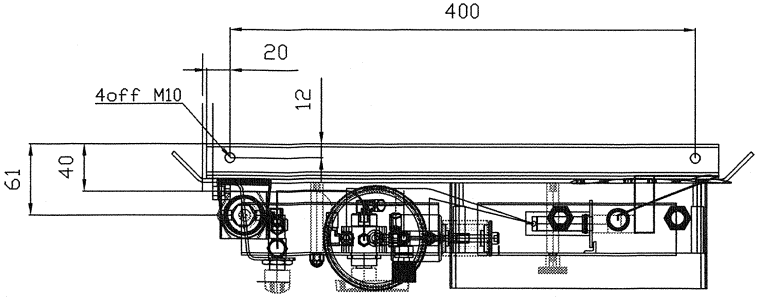
Side / Sheet 1 av / of 1 sider / sheets

Forandringer: REV 00) 20061123/ET

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others.The receiver is responsible for every misuse.







03
WEIGHT: 12 KG

Itemref	Quantity	Title/Name, designation, material, dimension etc	Article No./Ref.
331	1	Bubble glass complete	
358	1	Selector valve sample/test gases	
728	1	Oxygen Analyzer 220V AC	
477	1	Sensor Cable compleete	
407	1	Coverplate – Sensor – Stainless	
390	1	Sensor complete with O-ring/disc	
395	1	Filter set	
403	1	Span gas Filter Regulator	
404	1	Zero gas Regulator	
739	1	Selector Valve – test gases	
745	1	Flow control valve, 1/8"	

Rev	Date	Sign.	Description
03	20070607		WEIGHT ADDED
02	20070111		CONNECTION DETAILS ADDED
01	20050705		

MOSS STANDARD
Bestiller Purchaser
770000 Ordre nr. Order No.

Gruppe nr. Group No.	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. Appr'd	Dato Date	Skala Scale	Erstn. for Replaces	Erstattet av Replaced by
6400		ESt			20050705	/		

Proj.metode Proj.method

Hamworthy Moss AS

Tittel Title

O2 ANALYSER PANEL

ITEM 232

Tegn. nr. Draw.No.	Rev.
77-058-01	03

Side Sheet 1 av of 1 sider sheets

LIST OF DRAWINGS

Drawing no.:	Rev:	Description:
130959-110-01		Main Control Panel, touch screen, panel layout
130959-110-02		Main Control Panel, touch screen, start
130959-110-03		Main Control Panel, touch screen, alarm indication
130959-112-01		Main Control Panel, C.D., Parts list
130959-112-02		Main Control Panel, C.D., PLC layout
130959-112-03		Main Control Panel, C.D., Power/Signal distribution
130959-112-04		Main Control Panel, C.D., Digital signals
130959-112-05		Main Control Panel, C.D., Digital signals
130959-112-06		Main Control Panel, C.D., Digital signals
130959-112-07		Main Control Panel, C.D., Digital signals
130959-112-08		Main Control Panel, C.D., Analogue signals
130959-112-09		Main Control Panel, C.D., Analogue signals
130959-114-01		Local Control Panel, T.G., panel layout
130959-114-02		Local Control Panel, T.G., circuit diagram
130959-114-03		Local Control Panel, T.G., touch screen, local start
130959-114-04		Local Control Panel, T.G., touch screen, local alarms
130959-117-01		Sub Panel for ECR, term. list X16
130959-118-01		Sub Panel for Wheel House, Term. List X15
130959-120-01		Customer’s Cable Connection
130959-122-01		Alarm/Stop Description
130959-124-01		Power Distribution Panel, Term. List X3
130959-125-01		Intrinsic Safe Panel, Term. List X13, X14
130959-127-01		Starter Blower No. 1, Item 241
130959-127-02		Starter Blower No. 1, circuit diagram
130959-128-01		Starter Blower No. 2, Item 242
130959-128-02		Starter Blower No. 2, circuit diagram

Drawing no.:	Rev:	Description:
130959-133-01		Starter Fuel Oil Pump, item 243-G
130959-138-01		Starter Generator Blower, item 241-G
130959-150-01		Program Control Time Sequence, Flue Gas mode
130959-150-02		Program Control Time Sequence, Air vent mode
130959-150-03		Program Control Time Sequence, TG mode
130959-152-01		Term. box X4 and conn. on pneum. panel
130959-156-01		Main control panel, Manual override

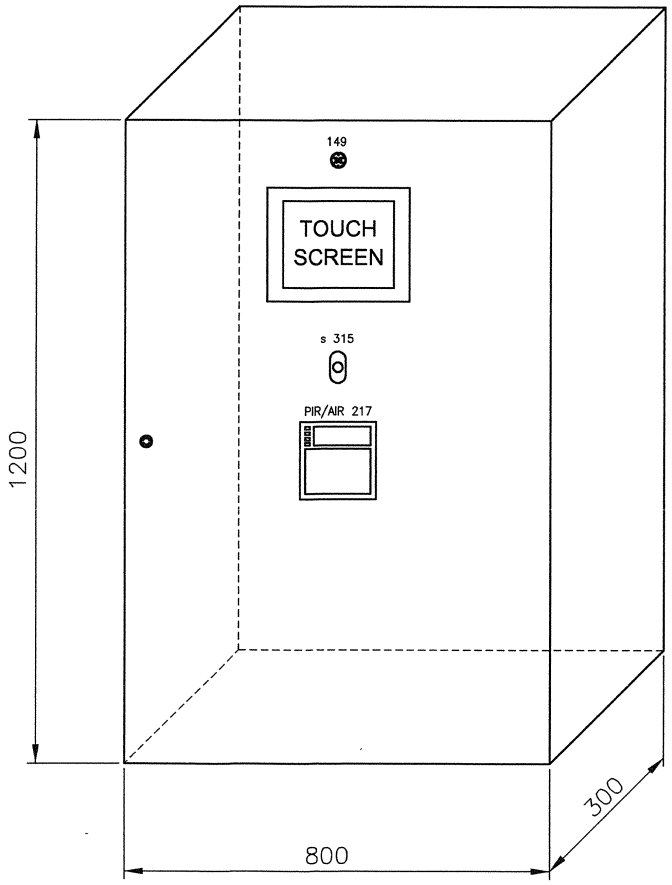
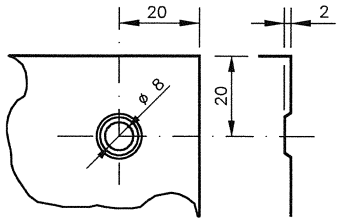


ILLUSTRATION COLOURS	
COMBUSTION AIR	GREY
SEALING AIR / FRESH WATER / IGNITION AIR	BLUE
SEA WATER / EFFLUENT	GREEN
FUEL OIL	BROWN
INERT GAS	PURPLE
FLAME / BOILER GAS	RED



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.

COLOUR : MUNSELL 7,5 BG 7/2 (01)
WEIGHT : 85 KG.
ENCLOSURE : IP44

Item No.	Qty.	REF. NO.	DESCRIPTION	TYPE
5	1		CABINET	RITTAL AE 1280.500
4	1	149	BUZZER	OLTEN 14810.002
3	1	PIR/AIR 217	2-PEN RECORDER	FUJI PHC33
2	1		TOUCH SCREEN	SCHNEIDER ELECTRIC XBTGT 5330
1	1	s 315	EMERGENCY STOP W/PROTECTION	ABB KPMP3-10R+KA1-8053+KCBHS-10+KCBH-01

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Rev.	Dato Sign.	Forandringer
01	20070717/	COLOUR WAS RAL 7035.
00	20061129/LON.	

MEG. Utf.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

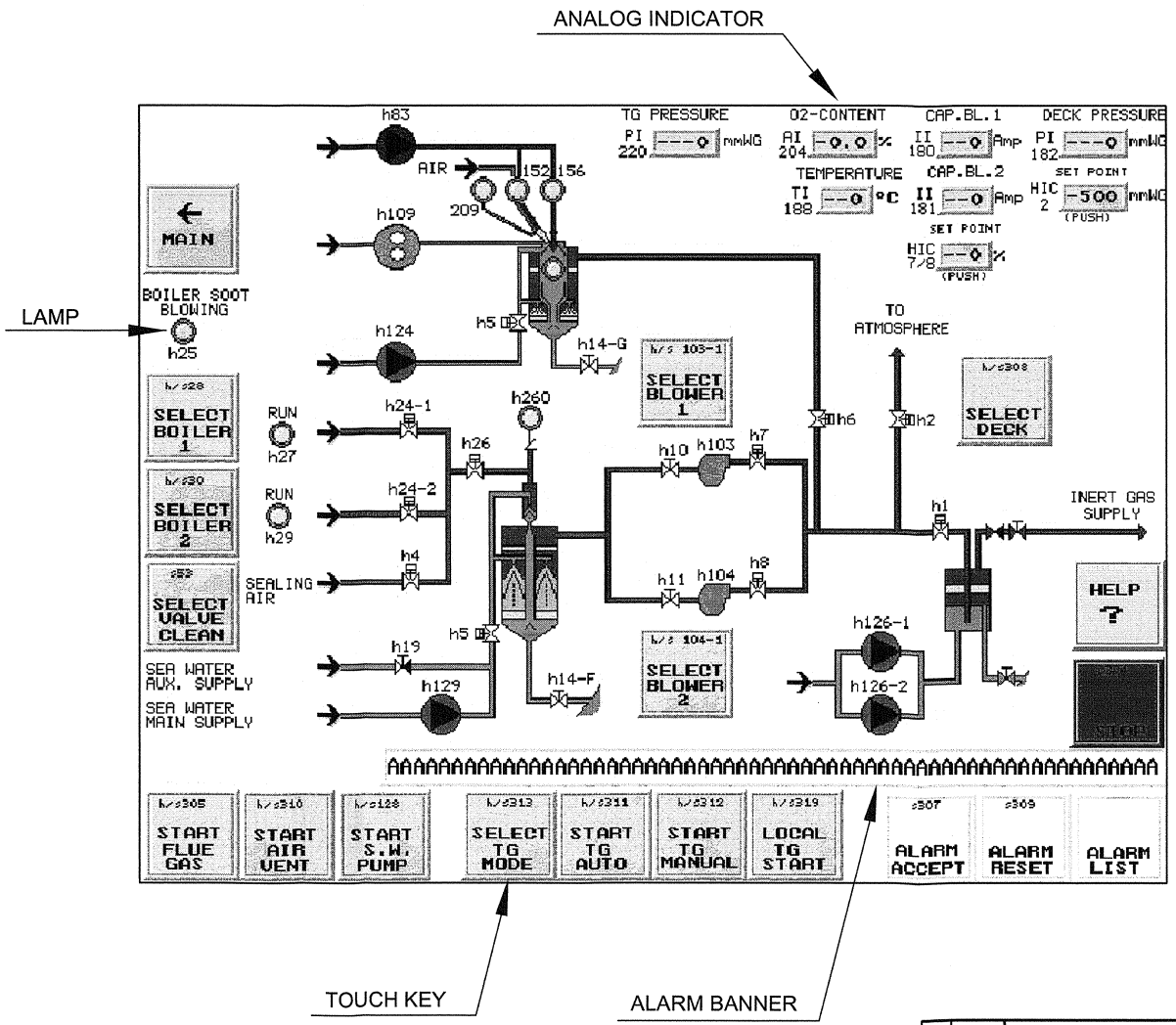
MOSS INERT GAS SYSTEM

Title
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
MAIN CONTROL PANEL
PANEL LAYOUT
ITEM 233

Erstn. for Replaces
Erstattet av Replaced by

130959-110-01 Rev. 01

Side Sheet 1 av of 3 sider sheets | Format A3



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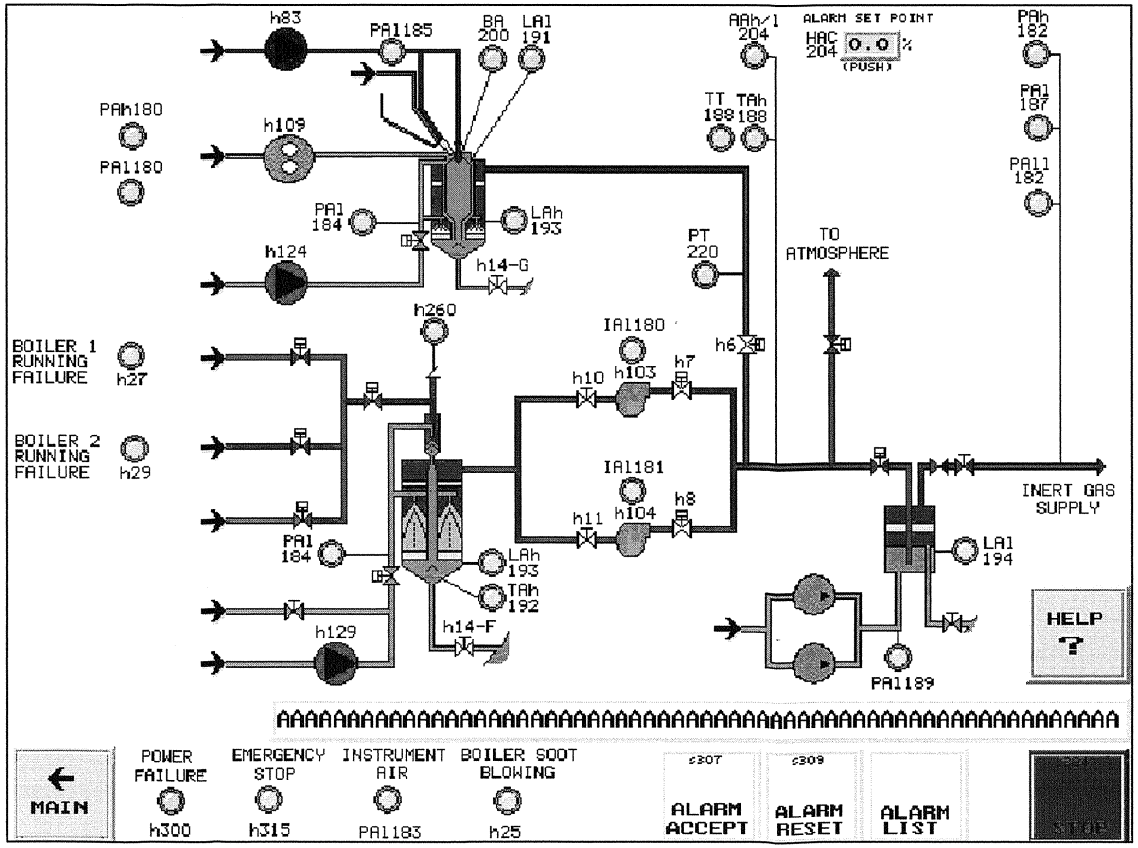
MEG. Ufs.sign. Issuer sign.											
DUNQNAT S.Y. H 8239 Bestiller Purchaser											
130959 Ordre nr. Order No.											
	00	20061129/	Forandringer								
	Rev.	Dato Sign.									
	Gruppe nr. Group No. 6400		Dato Date 20061129	Tegnet Drawn	Tracet Traced BT.	Kontr. Checked	Godkj. App'd. ET	Skala Scale			
	Proj.metode Proj.method		MOSS INERT GAS SYSTEM				Erstn. for Replaces	Erstattet av Replaced by			
	Hamworthy Moss AS		Title FLUE GAS SYSTEM + TOPPING UP GENERATOR MAIN CONTROL PANEL TOUCH SCREEN START				130959-110-02	Rev. 00			
							Side Sheet 2 av of 3 sider sheets	Format A3			



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MEG.	Utf.sign. Issuer sign.								
DUNQNAT S.Y. H 8239	Bestiller Purchaser	00	20061129/	Forandringer					
130959	Ordre nr. Order No.	Rev.	Dato Sign.						

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR MAIN CONTROL PANEL TOUCH SCREEN ALARM INDICATION

Erstn. for Replaces | Erstattet av Replaced by

130959-110-03 | Rev. 00

Side Sheet 3 av of 3 sider sheets | Format A3

ITEM	ANT.	POS. NO.	DESCRIPTION	SUPPLIER	MAKE
31	3	IS 180-1, 180-2, TS 188	LIMIT SWITCH	PR	PR 4116
30	3	R/I 2, 7, 8	MAN. SIGNAL TO VALVE	PR	PR 4116
29	3	R2, 7, 8	POT. METER W/DIAL	PR	PR 7009+7011
28	1	h40	LED RED	EAQ. LED	17.041353
27	1	S309	PUSH BUTTON	OLTEN	51.121025
26	1	S211	AUTO/MAN. SWITCH	J.F KNUTSEN	5656A
25	2	K30, 31	TIME RELAY 20 SEC	CARLO GAVAZZI	PAA01DM24
24	7	K20, 21, 22, 23, 24, 25-1, 25-2	TIME RELAY 20 SEC	CARLO GAVAZZI	PBB01DM24
23	1	PIR/AIR 217	2-PEN RECORDER	FUJI	PHC33
22	1	I/I 204	ISOLATION AMPLIFIER	PR	PR 4116 + PR 4501
21	3	K2, 3, 4	RELAY	RELPOL	R4-2013-23-1024-WT 24VDC
20	1	K1	RELAY	RELPOL	R15-2013-23-1024-WT 24VDC
19	1	G01	230V AC SOCKET OUTLET	MOELLER	Z-SD/230VAC
18	1	X100	ETHERNET SWITCH 10/100 BASE TX	SCHNEIDER ELECTRIC	499 NES 25100
17	2	FOR X61, 62	ANALOGUE CABLE 25-WAY SUB D	SCHNEIDER ELECTRIC	TSX CAP 030
16	1	X62	ANALOGUE OUTPUT MODULE	SCHNEIDER ELECTRIC	ABE-7CPA02
15	1	X61	ANALOGUE INPUT MODULE	SCHNEIDER ELECTRIC	ABE-7CPA02
14	8	FOR X20, 21, 22, 23, 40, 41, 42, 43	CABLE WITH 2xHE10 CONTACTS	SCHNEIDER ELECTRIC	TSX CDP 203 (2m)
13	1	X22	RELAY OUTPUT TERMINAL UNIT	SCHNEIDER ELECTRIC	ABE-7R08 S111
12	1	FOR X21	SNAP ON TERMINAL BLOCK FOR X21	SCHNEIDER ELECTRIC	ABE-7BV 10
11	1	X20	POT. FREE OUTPUT TERMINAL UNIT	SCHNEIDER ELECTRIC	ABE-7R16 S210
10	2	X21, 23	RELAY OUTPUT TERMINAL UNIT	SCHNEIDER ELECTRIC	ABE-7R16 S212
9	4	X40, 41, 42, 43	DIGITAL INPUT TERMINAL UNIT	SCHNEIDER ELECTRIC	ABE-7H16 R21
8	1	PLC 235	PCMCIA E2 PROM 224K	SCHNEIDER ELECTRIC	TSX MFPP 224K
7	1	PLC 235	DIGITAL OUTPUT MODULE	SCHNEIDER ELECTRIC	TSX DSY 64T2K
6	1	PLC 235	DIGITAL INPUT MODULE	SCHNEIDER ELECTRIC	TSX DEY 64D2K
5	1	PLC 235	ANALOGUE OUTPUT MODULE	SCHNEIDER ELECTRIC	TSX ASY 800
4	1	PLC 235	ANALOGUE INPUT MODULE	SCHNEIDER ELECTRIC	TSX AEY 800
3	1	PLC 235	POWER SUPPLY	SCHNEIDER ELECTRIC	TSX PSY 1610M
2	1	PLC 235	PLC RACK	SCHNEIDER ELECTRIC	TSX RKY 8
1	1	PLC 235	CPU	SCHNEIDER ELECTRIC	TSX P571634M

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MEG. Uts.sign. Issuer sign.

DUNQNAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Rev.	Dato Sign.	Forandringer
00	20061129/ Lan	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	Lan	BT.	AO	ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

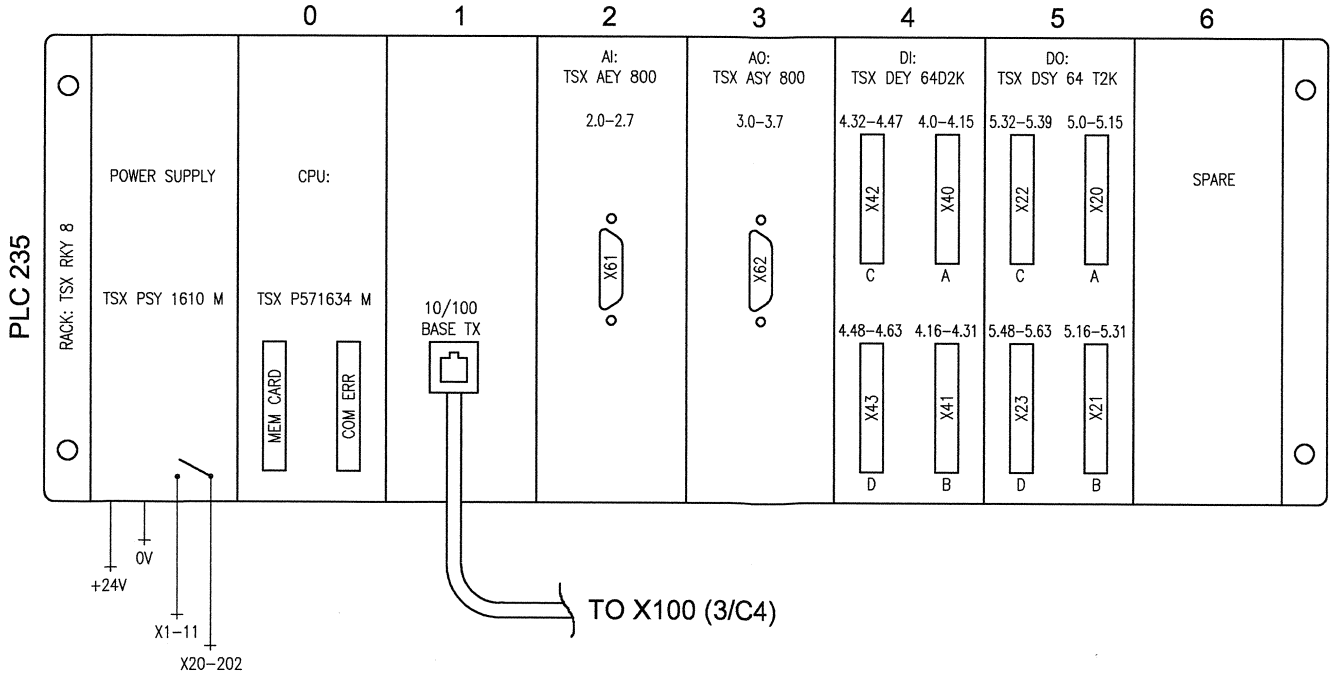
Title
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
PARTS LIST

Erstn. for Replaces

Erstattet av Replaced by

130959-112-01 Rev. 00

Side Sheet 1 av of 9 sider sheets Format A3



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Rev.	Dato Sign.	Forandringer
00	20061129/[signature]	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	[signature]	BT.	[signature]	ET	

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for / Replaces

Erstattet av / Replaced by

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
PLC LAYOUT

Hamworthy Moss AS

130959-112-02 Rev. 00

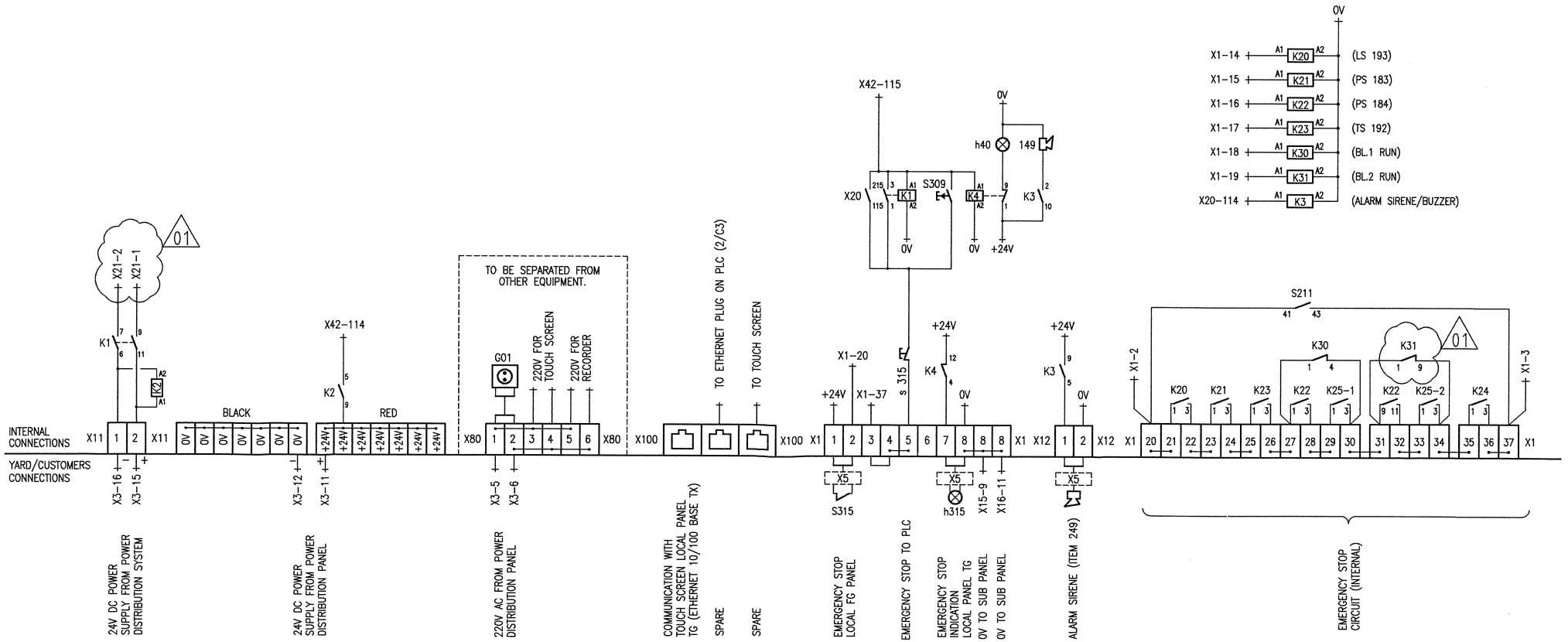
Side / Sheet 2 av / of 9 sider / sheets

Format A3

Ordre nr. / Order No.: 130959

Bestiller / Purchaser: DUNQNAT S.Y. H 8239

Uts.sign. / Issuer sign.: MEG.



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Rev.	Dato Sign.	Forandringer
01	20070925/JGO	CHANGED NUMBERS ON K1 AND K31.
00	20061129/LON.	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	JGO	BT.	Lon	ET	

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for Replaces | Erstattet av Replaced by

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
POWER/SIGNAL DISTRIBUTION

Hamworthy Moss AS

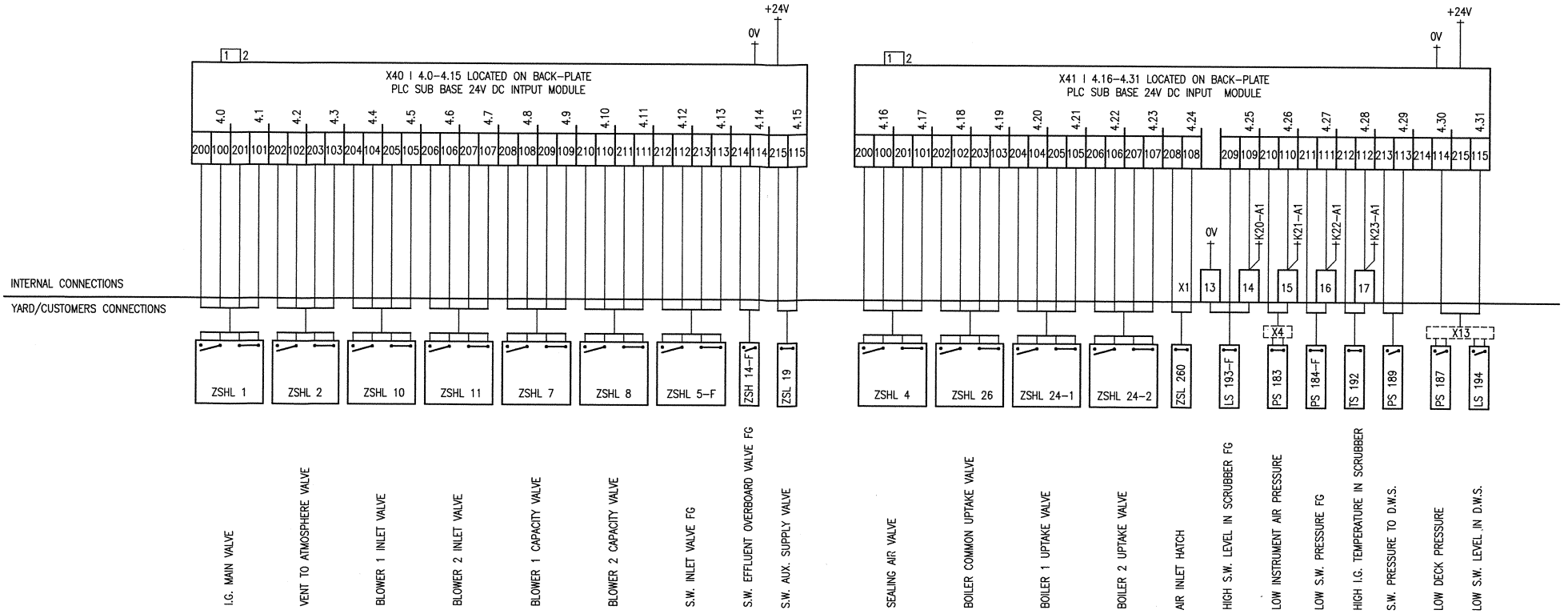
130959-112-03 | Rev. 01

Side Sheet 3 av of 9 sider sheets | Format A3

130959 DUNQNAT S.Y. H 8239 MEG.

Ordre nr. Order No. | Bestiller Purchaser | Uts.sign. Issuer sign.

NOTE:
LIMIT SWITCH POSITION INDICATED ARE
POSITIONS WHEN VALVE IS IN CLOSED POSITION.



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Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

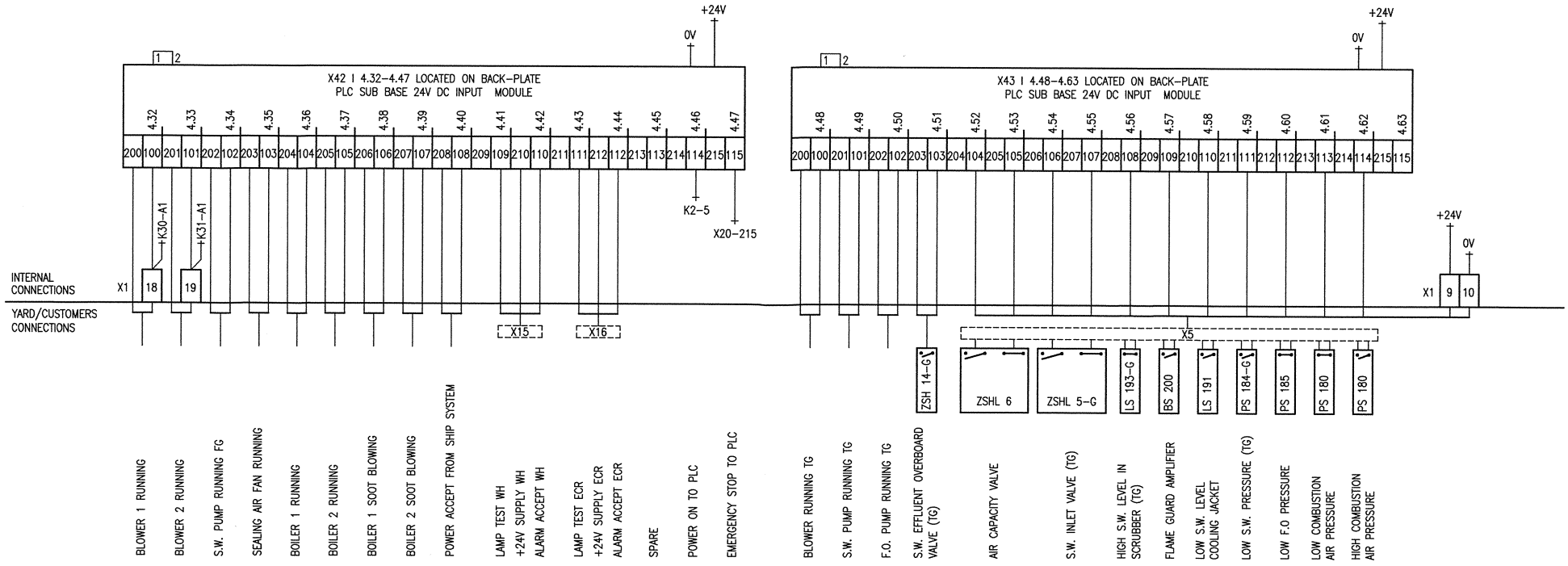
Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
DIGITAL SIGNALS

Erstn. for / Replaces | Erstattet av / Replaced by

130959-112-04 | Rev. 00

Side / Sheet 4 av / of 9 sider / sheets | Format A3

Uts.sign. / Issuer sign.: MEG.
Bestiller / Purchaser: DUNQNAT S.Y. H 8239
Ordre nr. / Order No.: 130959



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Uts.sign. Issuer sign.	MEG.
Bestiller Purchaser	DUNQNAT S.Y. H 8239
Ordre nr. Order No.	130959

Rev.	Dato Sign.	Forandringer
00	20061129/Lon	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	Lon	BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

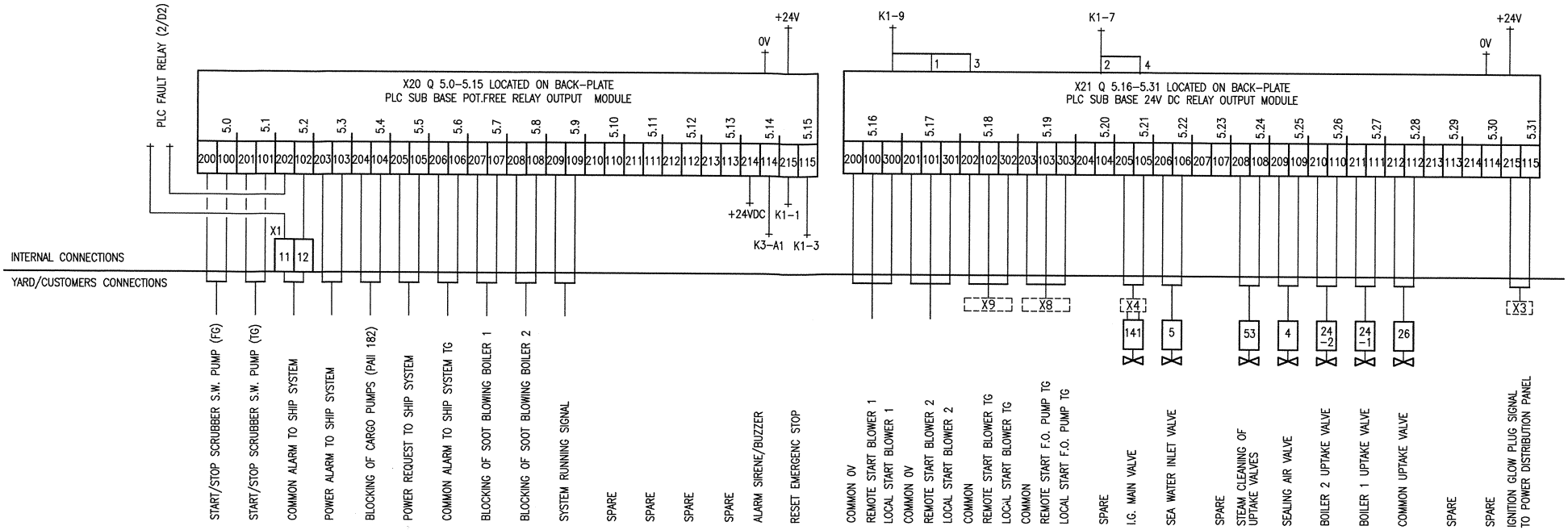
MOSS INERT GAS SYSTEM

Title
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
DIGITAL SIGNALS

Erstn. for Replaces	Erstattet av Replaced by

130959-112-05	Rev. 00

Side Sheet 5 av of 9 sider sheets — Format A3



NOTE :
COMMON ALARM TO SHIP SYSTEM INCLUDES ALL ALARMS FOR THE I.G. SYSTEM, ACCORDING TO THE ALARM/STOP DESCRIPTION DRAWING.
IN ADDITION TO THESE ALARMS THE FOLLOWING WILL ALSO TRIP THE COMMON ALARM: PLC FAULT, COMMUNICATION FAILURE WITH OPERATOR TERMINAL, SIGNAL FAULTS AND POWER FAILURE.
SECOND FAULT DETECTION WILL MAKE THE OUTPUT HIGH FOR 2 SECS. AND THEN FALL.

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Rev.	Dato Sign.	Forandringer
00	200611129/[signature]	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	[signature]	BT.	[signature]	ET	

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

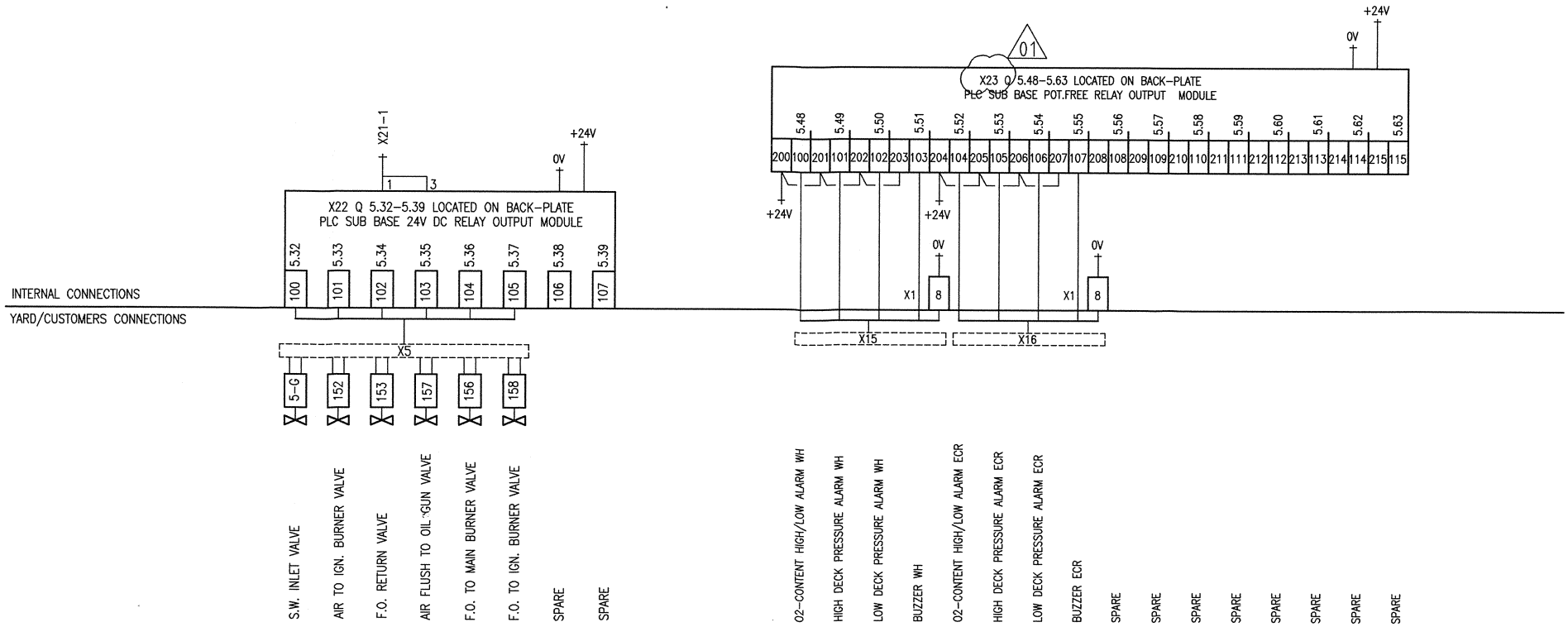
Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
DIGITAL SIGNALS

Erstn. for / Replaces | Erstattet av / Replaced by

130959-112-06 | Rev. 00

Side / Sheet 6 av / of 9 sider / sheets | Format A3

130959 DUNQNAT S.Y. H 8239 MEG.
Ordre nr. / Order No. | Bestiller / Purchaser | Uts.sign. / Issuer sign.



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Rev.	Dato Sign.	Forandringer
01	20070925/JO	CHANGED X20 TO X23.
00	LON.	

MEG. Uts.sign. Issuer sign.

MOSS STANDARD Bestiller Purchaser

130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	JO	BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

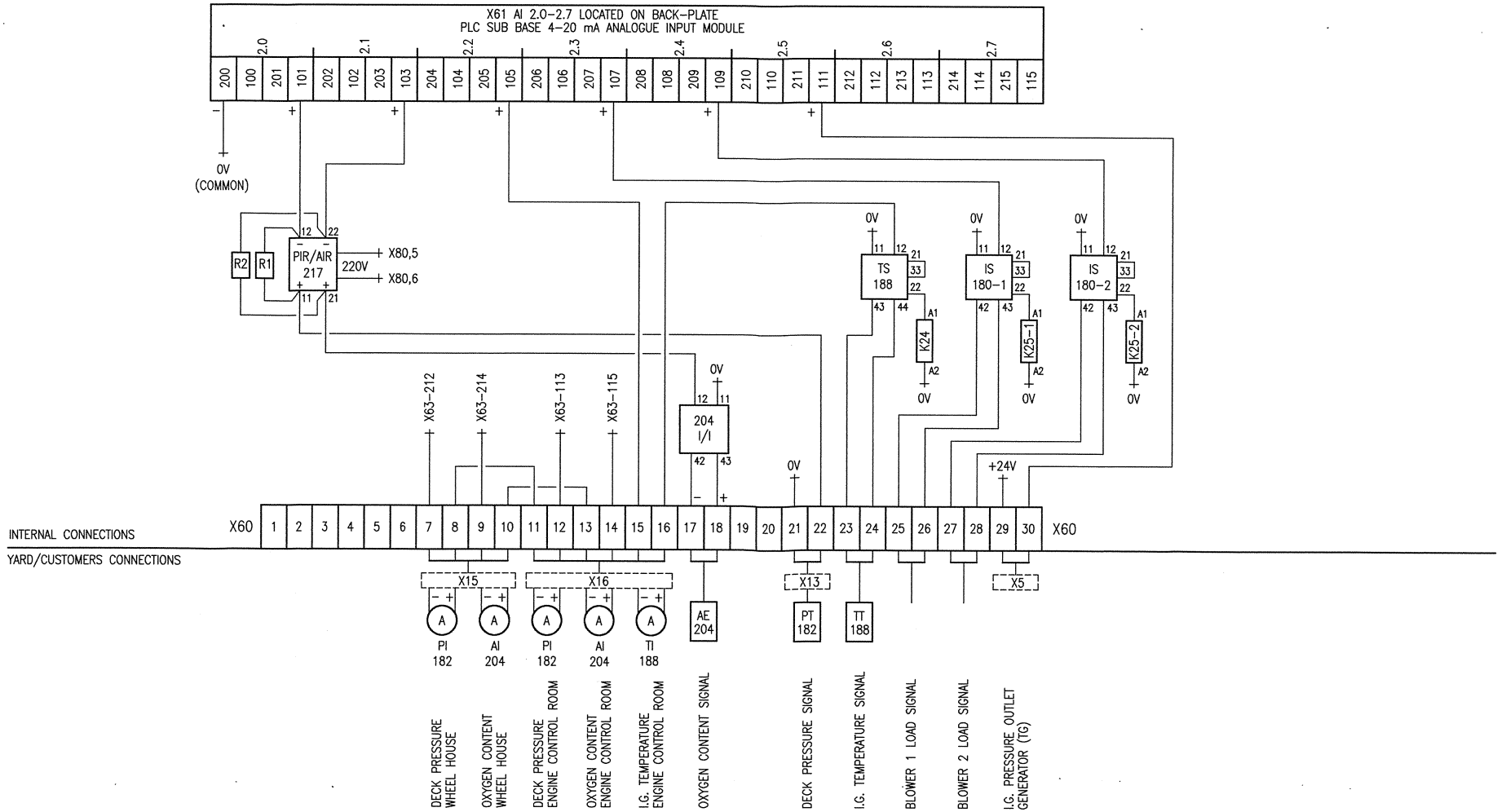
Title FLUE GAS SYSTEM + TOPPING UP GENERATOR MAIN CONTROL PANEL CIRCUIT DIAGRAM DIGITAL SIGNALS

Erstn. for Replaces

Erstattet av Replaced by

130959-112-07 Rev. 01

Side Sheet 7 av of 9 sider sheets Format A3



0V TO PIN : 31
24V TO PIN : 33

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MEG.	Uts.sign. Issuer sign.
DUNQNAT S.Y. H 8239	Bestiller Purchaser
130959	Ordre nr. Order No.

Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
ANALOGUE SIGNALS

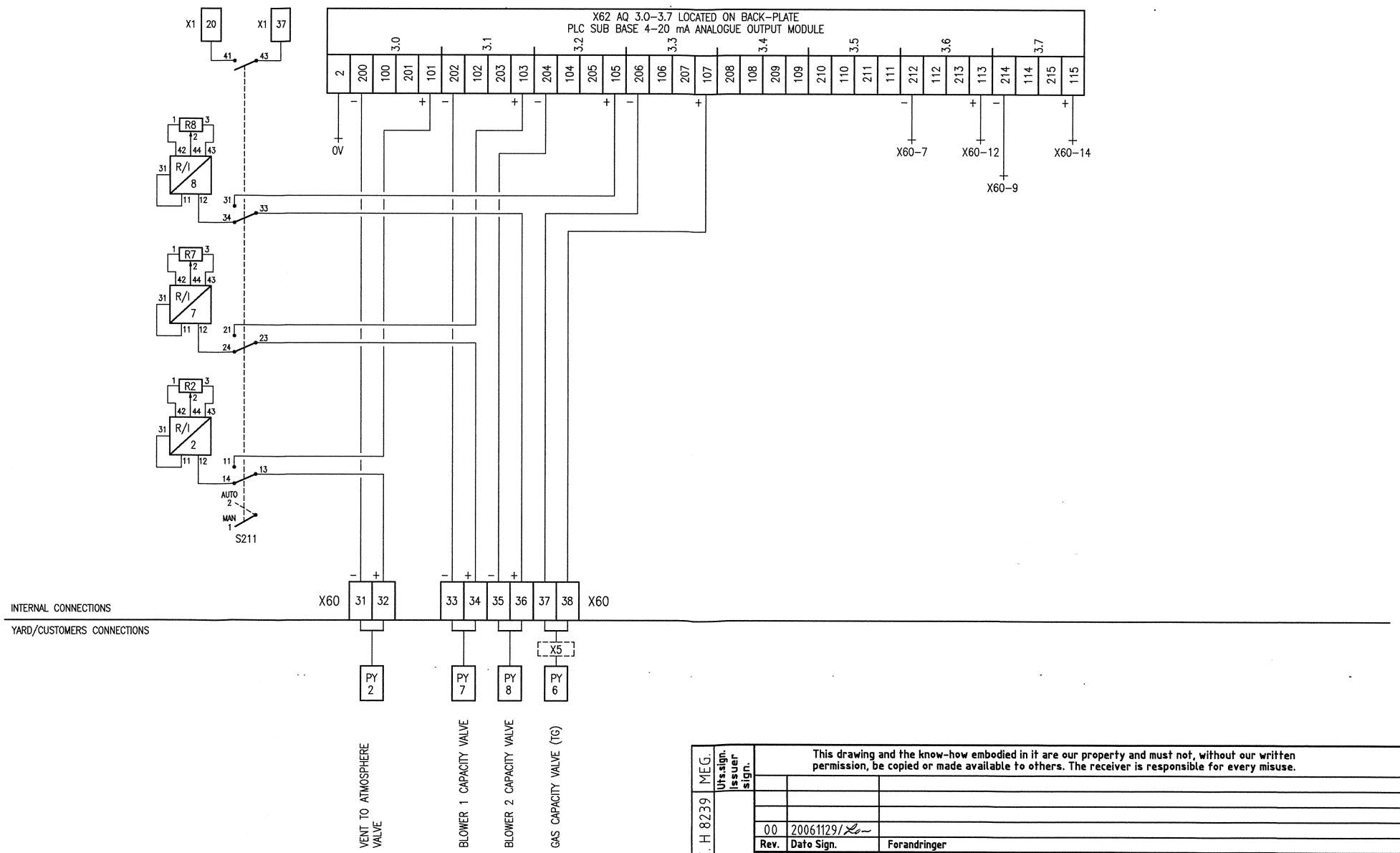
Erstn. for Replaces

Erstattet av Replaced by

130959-112-08 Rev. 00

Side Sheet 8 av of 9 sider sheets

Format A3



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Rev.	Dato Sign.	Forandringer
00	20061129/Lo~	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	Lo~	BT.	HO	ET	

Proj.metode / Proj.method

Bestiller Purchaser: Hamworthy Moss AS

Ordre nr. Order No.: 130959

DUNQNAT S.Y. H 8239

MEG. Utf.sign. Issuer sign.

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
MAIN CONTROL PANEL
CIRCUIT DIAGRAM
ANALOGUE SIGNALS

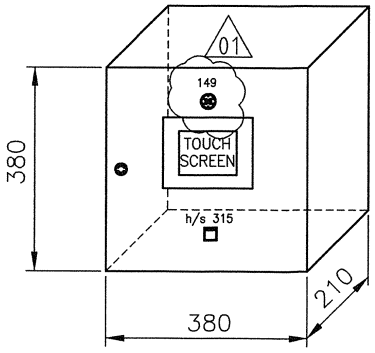
Erstn. for Replaces

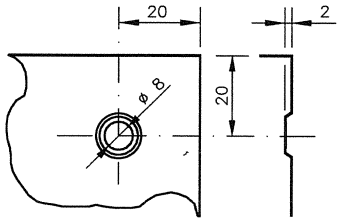
Erstattet av Replaced by

130959-112-09 Rev. 00

Side Sheet 9 av of 9 sider sheets

Format A3





4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.

1 OFF M50
3 OFF M20
} FOR YARD CABLE CONNECTIONS

COLOUR : MUNSELL 7,5 BG 7/2 01
~~WEIGHT : 15 KG.~~
ENCLOSURE : IP44

ILLUSTRATION COLOURS	
COMBUSTION AIR	GREY
SEALING AIR / FRESH WATER / IGNITION AIR	BLUE
SEA WATER / EFFLUENT	GREEN
FUEL OIL	BROWN
INERT GAS	PURPLE
FLAME / BOILER GAS	RED

Item No.	Qty.	REF. NO.	DESCRIPTION	TYPE
6	1		CABINET	RITTAL AE 1380.500
5	1	149	ALARM BUZZER	OLTEN 14810.002
4	1	R1	RESISTOR	7,4 Kohm
3	1	BS 200	FLAME DETECTOR SWITCH	PR 4116 + PR 4501
2	1	h/S 315	PUSH+LED RED W/PROT.	OLTEN 51.121.025
1	1	TOUCH SCREEN	SCHNEIDER ELECTRIC	XBTGT 2330

01

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Rev.	Dato Sign.	Forandringer
01	20070717/	COLOUR WAS RAL 7035, ADDED ALARM BUZZER.
00	20061129/LON.	

MEG. Uts.sign. Issuer sign.

DUNQNAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Gruppe nr. Group No.: 6400
Dato Date: 20061129
Tegnet Drawn:
Tracet Traced: BT.
Kontr. Checked: JGO
Godkj. App'd.: ET
Skala Scale:

Proj.metode Proj.method:

Hamworthy Moss AS

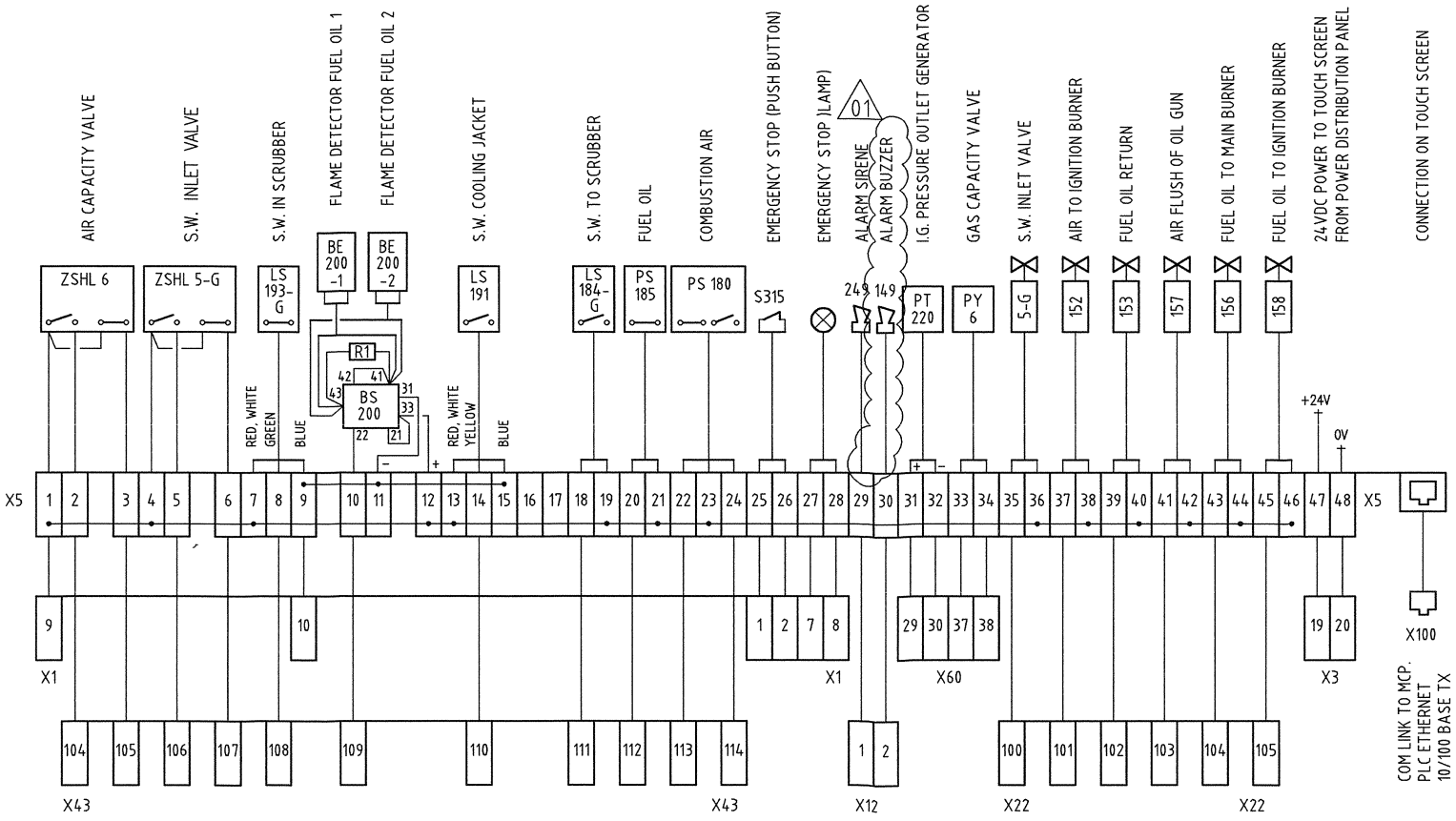
MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR
LOCAL CONTROL PANEL TG
PANEL LAYOUT
ITEM 234

Erstn. for Replaces:
Erstattet av Replaced by:

130959-114-01 Rev. 01

Side Sheet 1 av sider of 4 sheets
Format A3



NOTE:
LIMIT SWITCH POSITION INDICATED ARE
POSITIONS WHEN VALVE IS IN CLOSED POSITION.

0V TO PIN : 31
24V TO PIN : 33

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Rev.	Dato Sign.	Forandringer
01	20070717/	ALARM BUZZER ITEM 149 ADDED.
00	20061129/LON.	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JW	ET	

MEG. Uts.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM + TOPPING UP GENERATOR

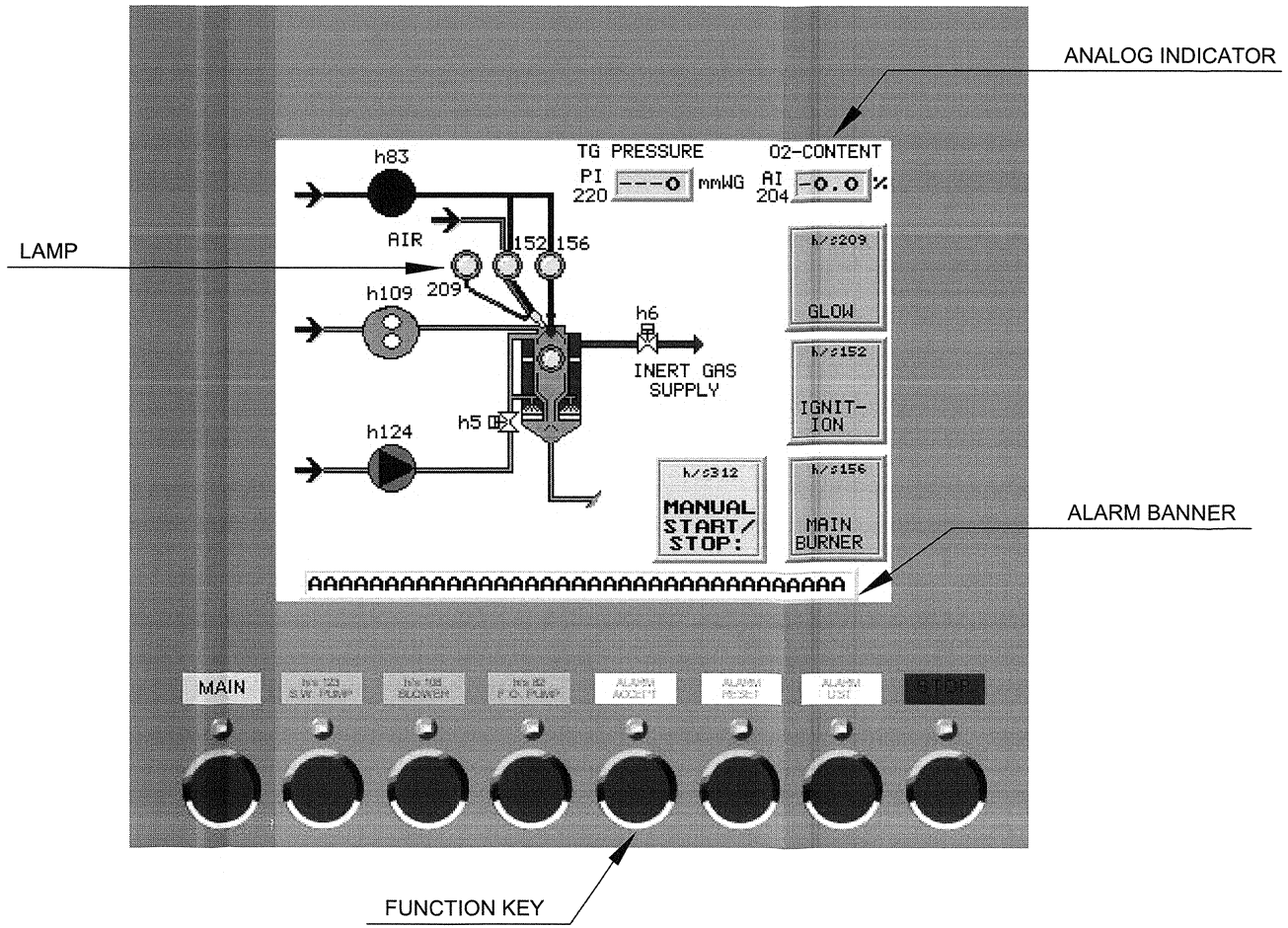
LOCAL CONTROL PANEL TG
CIRCUIT DIAGRAM

Erstn. for Replaces

Erstattet av Replaced by

130959-114-02 Rev. 01

Side Sheet 2 av of 4 sider sheets Format A3



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Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for / Replaces

Erstattet av / Replaced by

Hamworthy Moss AS

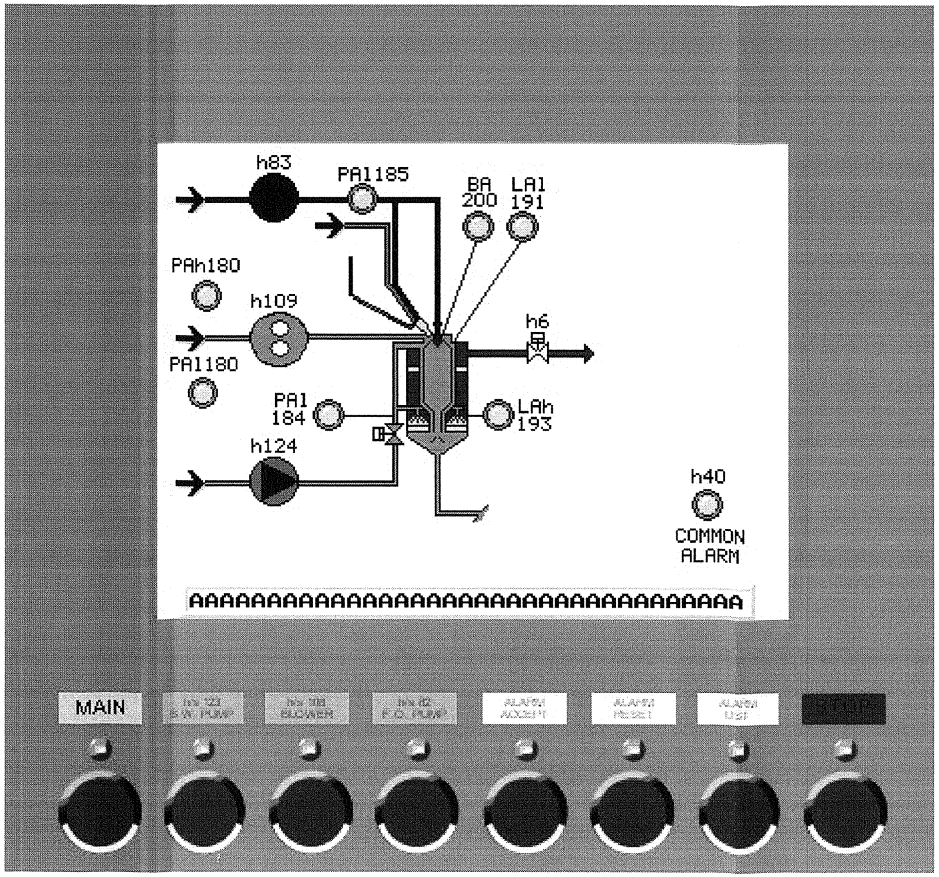
Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR LOCAL CONTROL PANEL TG TOUCH SCREEN LOCAL START

130959-114-03 Rev. 00

Side / Sheet 3 av / of 4 sider / sheets Format A3

130959 DUNQNAT S.Y. H 8239 MEG.

Ordre nr. / Order No. — Bestiller / Purchaser — Uts.sign. / Issuer sign.



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Rev.	Dato Sign.	Forandringer
00	20061129/[signature]	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	[signature]	BT.	[signature]	ET	

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for / Replaces

Erstattet av / Replaced by

Hamworthy Moss AS

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR LOCAL CONTROL PANEL TG TOUCH SCREEN LOCAL ALARMS

130959-114-04 Rev. 00

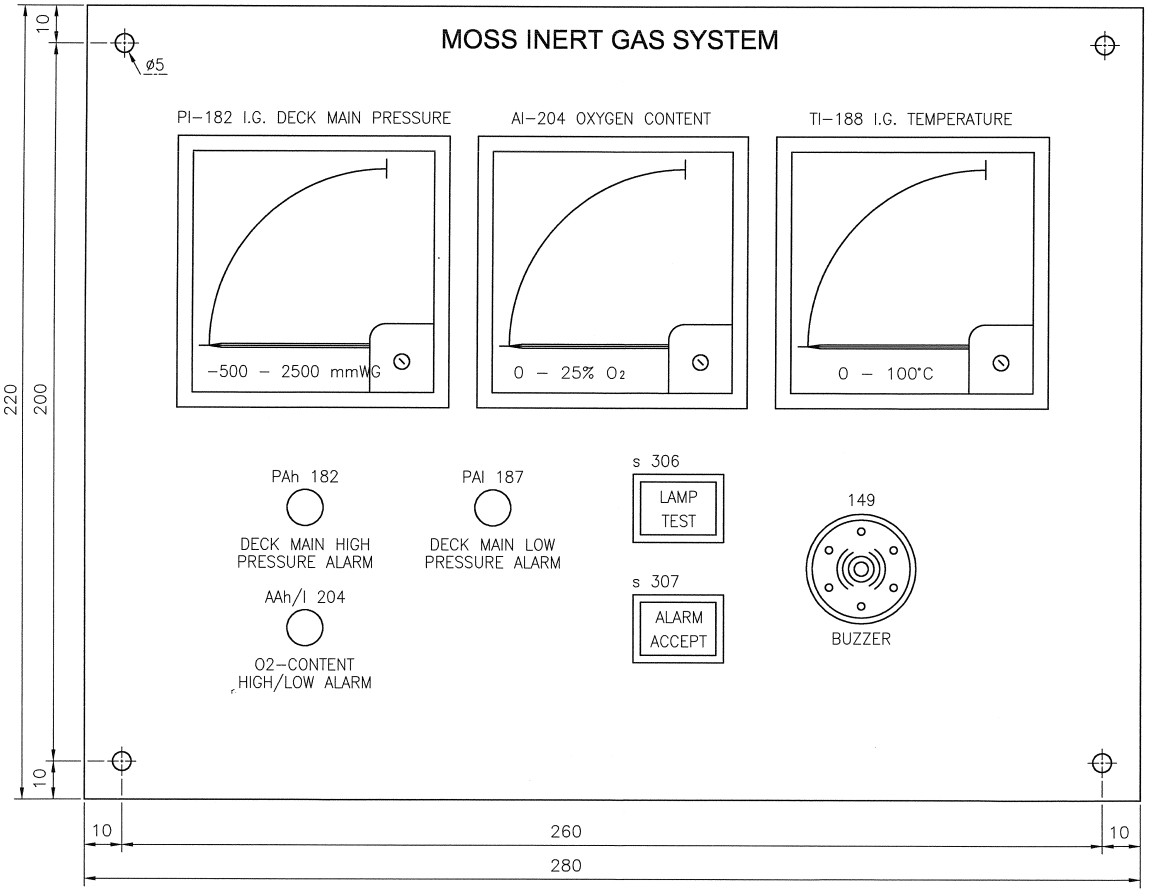
Side / Sheet 4 av / of 4 sider / sheets

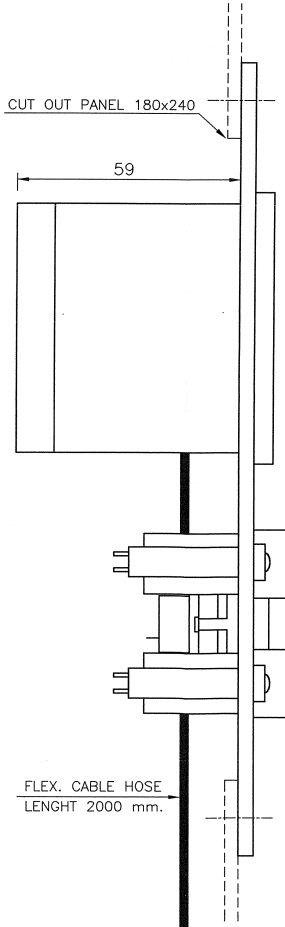
Format A3

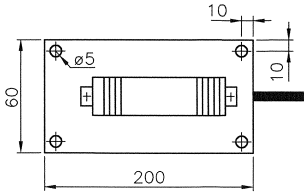
130959 DUNQNAT S.Y. H 8239 MEG.

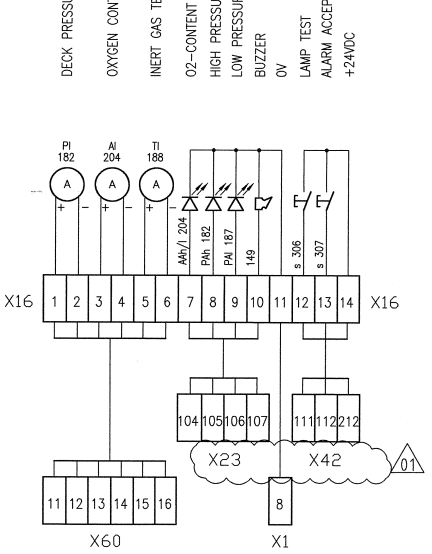
Ordre nr. / Order No. — Bestiller / Purchaser — Uts.sign. / Issuer sign.

MOSS INERT GAS SYSTEM









MATERIAL : ALUMINIUM (BRUSHED FINISH)

Item No.	Qty.	REF. NO.	DESCRIPTION	TYPE
5	1	149	BUZZER	OLTEN 14810.002
4	3	PI–182, TI–188, AI–204	INDIC. INSTRUMENT	DEIF DQ72
3	2	AAh/I 204, PAl 187	LED YELLOW	EAO. LED 17.041352
2	1	PAh 182	LED RED	EAO. LED 17.041353
1	2	s 306, 307.	PUSH BUTTON WHITE	OLTEN 51.121.025

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Rev.	Dato Sign.	Forandringer Revisions
01	20070925/JØ	CHANGED X20 TO X23 AND X43 TO X42.
00	20061129/LON.	

MEG. | Uts.sign. Issuer sign.

DUNQNAT S.Y. H 8239 — Bestiller Purchaser

130959 — Ordre nr. Order No.

Gruppe nr. Group No. 6400

Dato Date: 20061129 | Tegnet Drawn: JØ | Tracet Traced: BT. | Kontr. Checked: | Godkj. App'd.: ET | Skala Scale | Proj.metode Proj.method

Title: MOSS INERT GAS SYSTEM

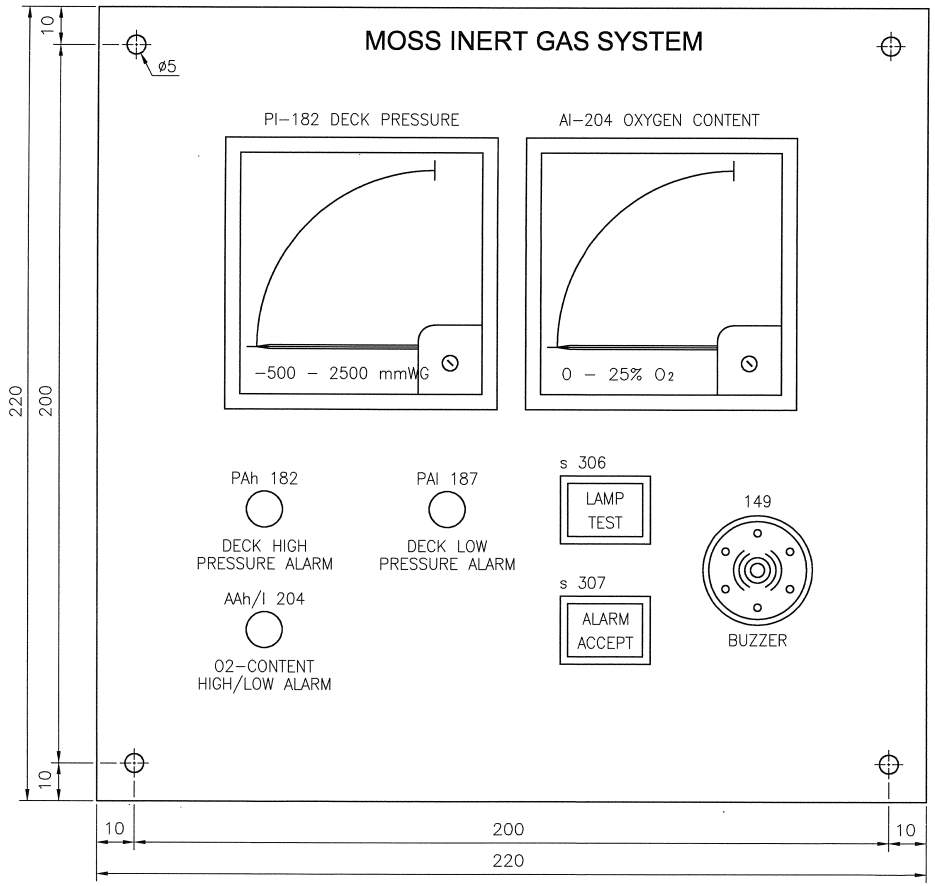
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
SUB PANEL FOR
ENGINE CONTROL ROOM
TERMINAL LIST X16
ITEM NO. 240

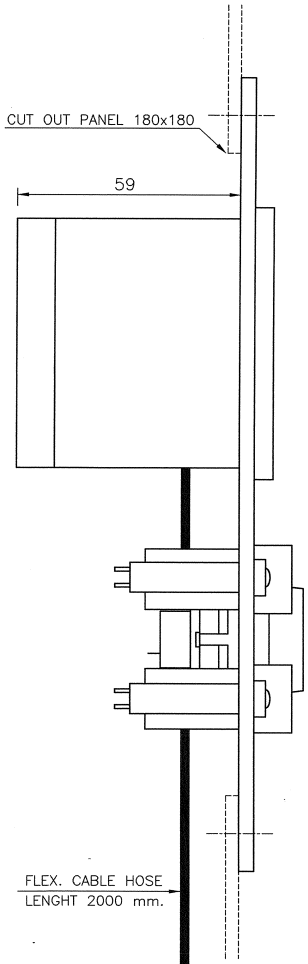
Hamworthy Moss AS

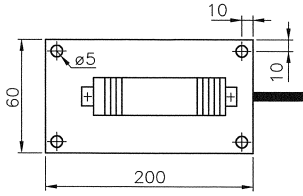
Erstn. for Replaces | Erstattet av Replaced by

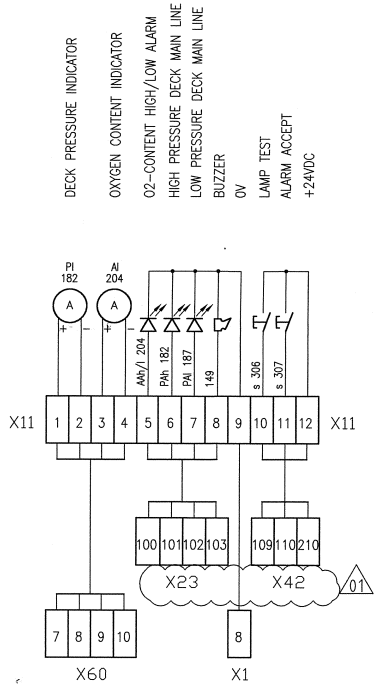
130959-117-01 | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A2









MATERIAL : ALUMINIUM (BRUSHED FINISH)

Item No.	Qty.	REF. NO.	DESCRIPTION	TYPE
5	1	149	BUZZER	OLTEN 14810.002
4	2	PI–182, AI–204	INDIC. INSTRUMENT	DEIF DQ72
3	2	AAh/I 204, PAI 187	LED YELLOW	EAO. LED 17.041352
2	1	PAh 182	LED RED	EAO. LED 17.041353
1	2	s 306, 307.	PUSH BUTTON WHITE	OLTEN 51.121.025

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Rev.	Dato Sign.	Forandringer Revisions
01	20070925/JHO	CHANGED X20 TO X23 AND X43 TO X42.
00	20061129/LON.	

MEG. | Uts.sign. Issuer sign.

DUNGNAT S.Y. H 8239 — Bestiller Purchaser

130959 — Ordre nr. Order No.

Gruppe nr. Group No. 6400

Dato Date: 20061129 | Tegnet Drawn: JHO | Tracet Traced: BT. | Skala Scale

Kontr. Checked | Godkj. App'd.: ET

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR

SUB PANEL FOR WHEEL HOUSE

TERMINAL LIST X15

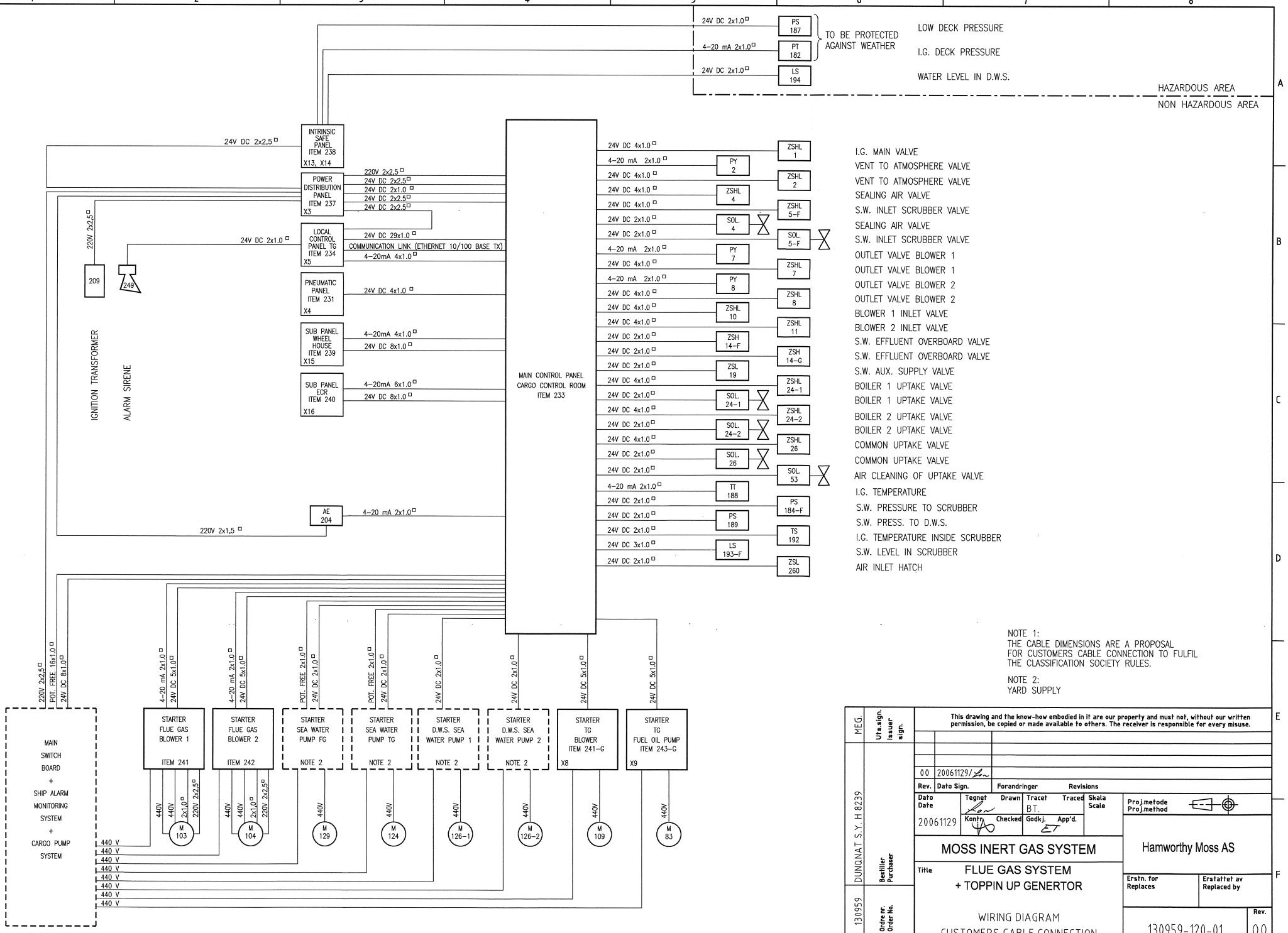
ITEM NO. 239

Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

130959-118-01 | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A2



NOTE 1:
THE CABLE DIMENSIONS ARE A PROPOSAL FOR CUSTOMERS CABLE CONNECTION TO FULFIL THE CLASSIFICATION SOCIETY RULES.

NOTE 2:
YARD SUPPLY

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MEG.	Ut's.sign. Issuer sign.
DUNQNAT S.Y. H 8239	Bestiller Purchaser
130959	Ordre nr. Order No.
Gruppe nr. Group No. 6400	

Rev.	Dato Sign.	Forandringer Revisions
00	20061129/	

Dato Date 20061129 | Tegnet Drawn | Tracet Traced BT. | Skala Scale | Kontr. Checked | Godkj. App'd. ET

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM + TOPPIN UP GENERTOR

WIRING DIAGRAM CUSTOMERS CABLE CONNECTION

Hamworthy Moss AS

Erstn. for Replaces | Erstattet av Replaced by

Rev. 00

130959-120-01

Side Sheet 1 av of 1 sider sheets | Format A2

ALARMS ON PLANT	MARK	GROUP	REM.
POWER FAILURE	h 300	F	
EMERGENCY STOP	h/s 315	A	1
HIGH SEA WATER LEVEL IN SCRUBBER	LAh-193 F	A	1
HIGH SEA WATER LEVEL IN COOLING JACKET	LAh-193 G	A	1
LOW INSTRUMENT AIR SUPPLY PRESSURE	PAl-183	A	1
BLOWER 1/2 LOAD LOW	IAl-180/181	B	1
HIGH COMBUSTION AIR PRESSURE	PAh-180	B	1
LOW COMBUSTION AIR PRESSURE	PAl-180	B	1
HIGH I.G. TEMPERATURE	TAh-188	B	1
HIGH I.G. TEMP. IN SCRUBBER	TAh-192	B	1
LOW SEA WATER LEVEL IN COOLING JACKET	LAl-191	B	1
FLAME FAILURE	BA 200	B	1
LOW FUEL OIL SUPPLY PRESSURE TO BURNER	PAl-185	B	1
LOW SEA WATER SUPPLY PRESSURE FLUE GAS	PAl-184 F	B	1
LOW SEA WATER SUPPLY PRESSURE T.U.G.	PAl-184 G	B	1
LOW SEA WATER SUPPLY PRESSURE TO DECK WATER SEAL	PAl-189	D	2
LOW SEA WATER LEVEL IN DECK WATER SEAL	LAl-194	D	2
HIGH GAS PRESSURE IN "MAIN INERT GAS LINE"	PAh-182	C	1
LOW GAS PRESSURE IN "MAIN INERT GAS LINE"	PAl-187	D	
LOW/LOW PRESSURE IN "MAIN INERT GAS LINE"	PAll-182	E	
HIGH/LOW OXYGEN CONTENT	AAh/l-204	C	
MOTOR FAILURE, BLOWERS	h 103/104	B	
MOTOR FAILURE, SEA WATER PUMP - FLUE GAS	h 129	A	
MOTOR FAILURE, SEA WATER PUMP - T.U.G.	h 124	A	
SIGNAL FAULT I.G. TEMPERATURE	TT-188	D	
SIGNAL FAULT I.G. PRESSURE OUTLET T.U.G.	PT-220	D	

ALARM GROUP		DESCRIPTION OF GROUP ALARMS
A		ACTION
ALARM/ INSTANTA-NEOUS STOP	1	ALL AUTOMATIC VALVES TO SHUT DOWN POSITION
	2	STOP OF ALL MOTORS (NOT S.W. SUPPLY PUMP TO D.W.S.)
	3	AUDIBLE AND VISUAL ALARM
	4	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	5	
B		ACTION
ALARM/ STOP	1	ALL AUTOM. VLV. EXEPT S.W. VALVES TO SHUT DOWN POSITION
	2	STOP OF OIL PUMPS AND BLOWERS
	3	AUDIBLE AND VISUAL ALARM
	4	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	5	S.W.SYST.IS SETT TO"COOL.DOWN TIME"STOP WHEN TIME IS OUT
C		ACTION
ALARM	1	ATMOSPHERE VALVE OPEN, CONSUMER VALVE CLOSED
	2	AUDIBLE AND VISUAL ALARM
	3	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	4	
D		ACTION
ALARM	1	AUDIBLE AND VISUAL ALARM
	2	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	3	
E		ACTION
ALARM	1	BLOCKING OF CARGO PUMPS WHEN TANK PRESS. P=<100 mm W.G.
	2	AUDIBLE AND VISUAL ALARM
	3	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	4	
F		ACTION
ALARM	1	TOTAL STOP
	2	OUTPUT ALARM SIGNAL TO E.O. ALARM SYSTEM
	3	

REMARK:

1: START SEQUENCE IS BLOCKED IF ALARM I ACTIVATED PRIOR TO START

2: IF INERT GAS MAIN VALVE IS CLOSED IT WILL NOT BE POSSIBLE TO SELECT INERT GAS TO CONSUMER UPON ALARM.

IF INERT GAS MAIN VALVE IS OPEN IT WILL REMAIN IN THIS POSITION UPON ALARM.

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MEG. Uts.sign. Issuer sign.

DUNG.NAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Rev.	Dato Sign.	Forandringer
00	20061129/ Lon	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129	Lon	BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

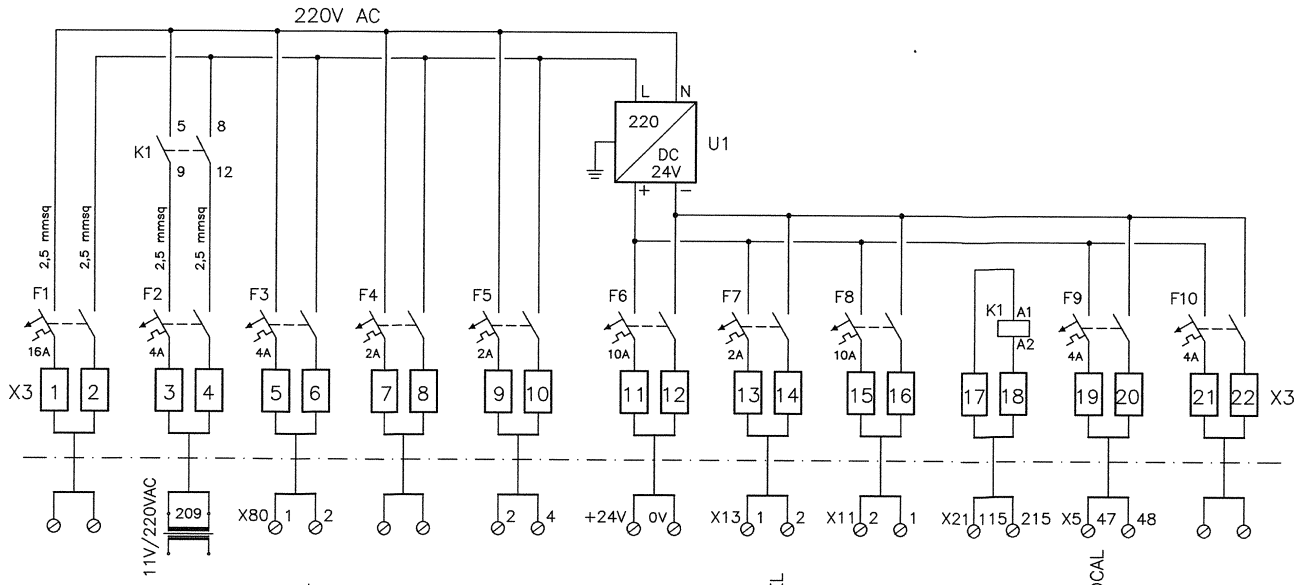
Title FLUE GAS SYSTEM + TOPPING UP GENERATOR

ALARM/STOP DESCRIPTION

Erstn. for Replaces | Erstattet av Replaced by

130959-122-01 Rev. 00

Side Sheet 1 av of 1 sider sheets | Format A3



POWER SUPPLY 220V AC FROM MAIN SWITCH BOARD

IGNITION GLOW PLUG TRANSFORMER

220V POWER TO MAIN CONTROL PANEL

SPARE

220V POWER TO O2-ANALYSER

24V DC TO MAIN CONTROL PANEL

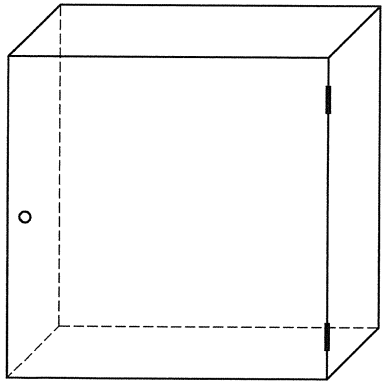
24V DC TO INTRINSIC SAFE PANEL

24V DC CONTROL POWER TO MAIN CONTROL PANEL

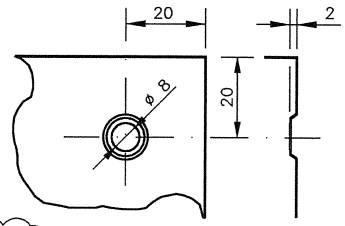
SIGNAL FROM MAIN CONTROL PANEL : GLOW PLUG

24VDC POWER TO LOCAL CONTROL PANEL TG

OPTIONAL 24VDC TO SUB PANEL



DIMENSIONS :
W = 600 mm
H = 600 mm
D = 210 mm



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.
9 OFF M25

COLOUR: MUNSELL 7,5 BG 7/2
WEIGHT: 40 KG.
ENCLOSURE: IP55

01

WARNING :
F1 MUST REMAIN IN POS. "ON" AND MUST ONLY BE SWITCED TO POS. "OFF" IN CASE OF EMERGENCY. IF THE MAIN FUSE IS IN POS. "OFF" THE LOW LEVEL ALARM IN D.W.S. AND THE DECK PRESSURE ALARMS ARE NOT OPERATIONAL

Qty.	Ref. no	Description	Make	Type
1		ENCLOSURE	RITTAL	AE 1060.500
1	K1	RELAY	RELPOL	R15-2013-23-1024-WT 24VDC
1	F1	CIRCUIT BREAKER	ABB	S202M-C16
4	F2, F3, F9, F10	CIRCUIT BREAKER	ABB	S202M-C4
2	F6, F8	CIRCUIT BREAKER	ABB	S202M-C10
3	F4, F5, F7	CIRCUIT BREAKER	ABB	S202M-C2
1	U1	POWER SUPPLY	NORATEL	RP1300-24C

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Rev.	Dato Sign.	Forandringer
01	20070717/	COLOUR WAS RAL 7035.
00	20061129/LON.	

MEG. Uts.sign. Issuer sign.

DUNQNAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JBO	ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

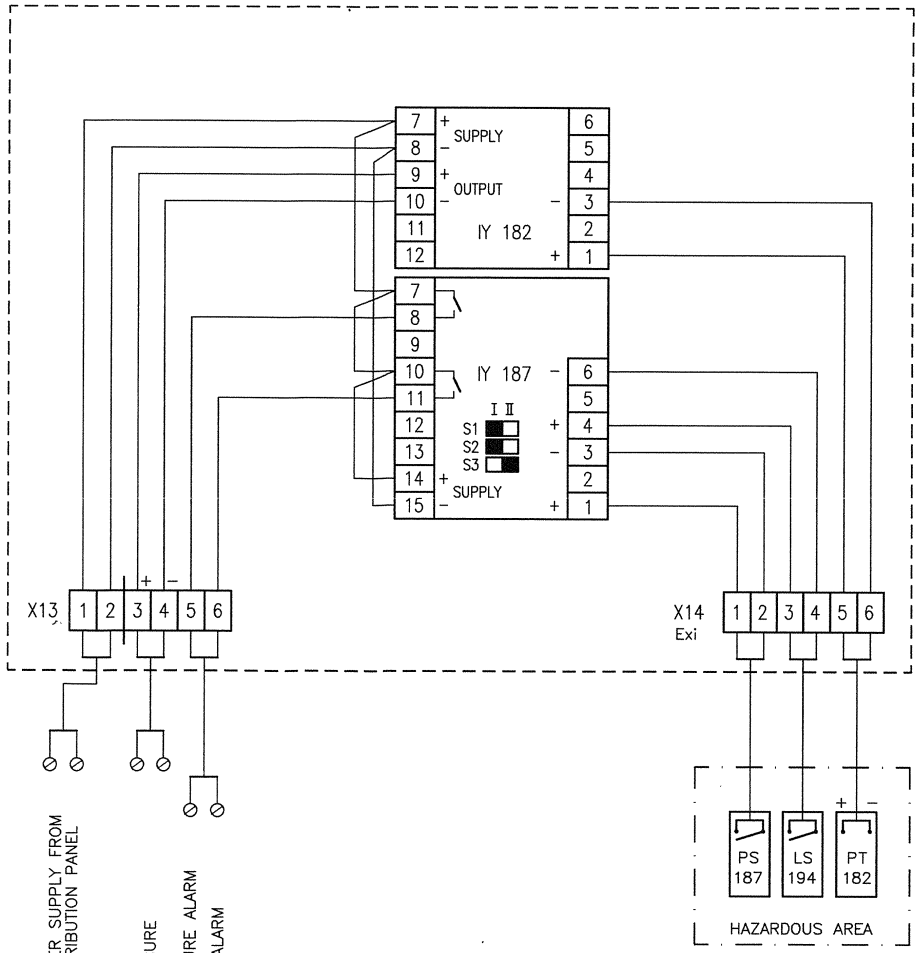
Title
FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
POWER DISTRIBUTION PANEL
TERMINAL LIST X3
ITEM 237

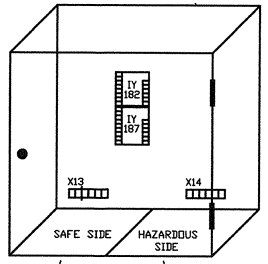
Erstn. for Replaces

Erstattet av Replaced by

130959-124-01 Rev. 01

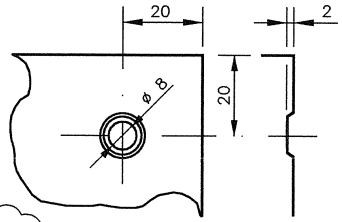
Side Sheet 1 av of 1 sider sheets Format A3





DIMENSIONS :
W = 380 mm
H = 380 mm
D = 210 mm

3 OFF M25 3 OFF M25



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.

COLOUR: MUNSELL 7,5 BG 7/2
~~WEIGHT: 15 KG.~~
ENCLOSURE: IP55

01

NOTE:
IN SOM CASES THE FOLLOWING ADDITIONAL/EQUIPMENT COULD BE ADDED:
– PT 190 GAS V.E.C.S. LINE PRESSURE + IY 190 (SAME AS IY 182)
– LS 195 HIGH LEVEL ALARM DWS + IY 195 (SAME AS IY 187)

QTY.	REF. NO.	DESCRIPTION	MAKE	TYPE
1		ENCLOSURE	RITTAL	AE 1380.500
1	IY 182	REPEATER POWER SUPPLY	P&F	KFD2-STC1-EX1
1	IY 187	SWITCH/PROXIMITY DETECTOR INTERFACE	P&F	KFD2-SR2-EX2, W

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Rev.	Dato Sign.	Forandringer
01	20070717/	COLOUR WAS RAL 7035.
00	20061129/LON.	

MEG. Utf.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JBO	ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

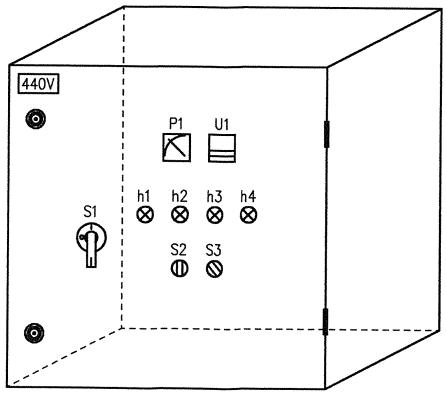
Title FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
INTRINSIC SAFE PANEL
TERMINAL LISTS X13, X14
ITEM 238

Erstn. for Replaces | Erstattet av Replaced by

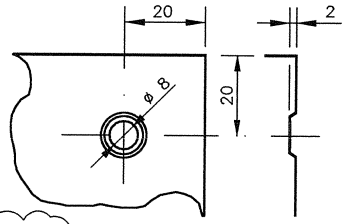
130959-125-01 | Rev. 01

Side Sheet 1 av of 1 sider sheets | Format A3

CLASSIFICATION :	ABS
WITNESS REQUIRED :	NO
SERIAL NO. :	6294



DIMENSIONS :
W = 600 mm
H = 600 mm
D = 210 mm



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.

03 COLOUR: MUNSELL 7,5 BG 7/2
~~WEIGHT: 80 KG~~
ENCLOSURE: IP44

h1 : POWER ON
h2 : RUNNING
h3 : HEATER ON
h4 : THERMISTOR ALARM

Qty.	Pos no.	Function	Make	Description
1		ENCLOSURE	RITTAL	AE 1060.500
1	S1	ISOLATION SWITCH	ABB	OT160E3+OTS160T3+OHB2AJ+OXP6x210
1	S2	SELECTOR SWITCH	Telemec	ZB2-BD3+ZB2-BZ103
1	S3	SWITCH	Telemec	ZB2-BD2+ZB2-BZ101+ZB2-BE101
1	K1	CONTACTOR	Siemens	3TF52 22-0X N2 (90KW / 210A)
2	K2, K3	RELAY	Telemec	CAD32-BD
1	K4	TIME DELAY RELAY	Telemec	RE7YR12BU
1	F1	OVERLOAD RELAY	Telemec	LRD-05C (0.63-1A)
2	F2, F3	CIRCUIT BREAKER	MG	C65HD206
1	F4	THERMISTOR RELAY	Telemec	LT3-SM00ED
1	P1	AMPERE-METER	Sunrise	BE-48 150/5A (IN MARKED RED)
1	h1	INDICATING LAMP	Telemec	XB2-BVM1LC WHITE
1	h2	INDICATING LAMP	Telemec	XB2-BVM3LC GREEN
1	h3	INDICATING LAMP	Telemec	XB2-BVM6LC BLUE
1	h4	INDICATING LAMP	Telemec	XB2-BVM4LC RED
1	T1	CURRENT TRANSFORMER	Sunrise	MFO-30 150/5A
3	T2	CURRENT TRANSFORMER	Sunrise	MFO-30 150/1A
1	T3	TRANSFORMER	Hongqi	440/220 400VA
1	U1	HOUR COUNTER	DEIF	HC48 24VDC IP65
1	U2	CURRENT TRANSDUCER	DEIF	TAC-311DG 0-5A/220VAC

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Rev.	Dato Sign.	Forandringer
03	20070717/	COLOUR WAS RAL 7035
02	20070531/LON.	K4 WAS RE7RB11MW.
01	20070504/LON.	F1 WAS LR2-D1305.
00	20061129/LON.	

MEG. Utf.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JØ	ET	

Proj.metode Proj.method

Hamworthy Moss AS

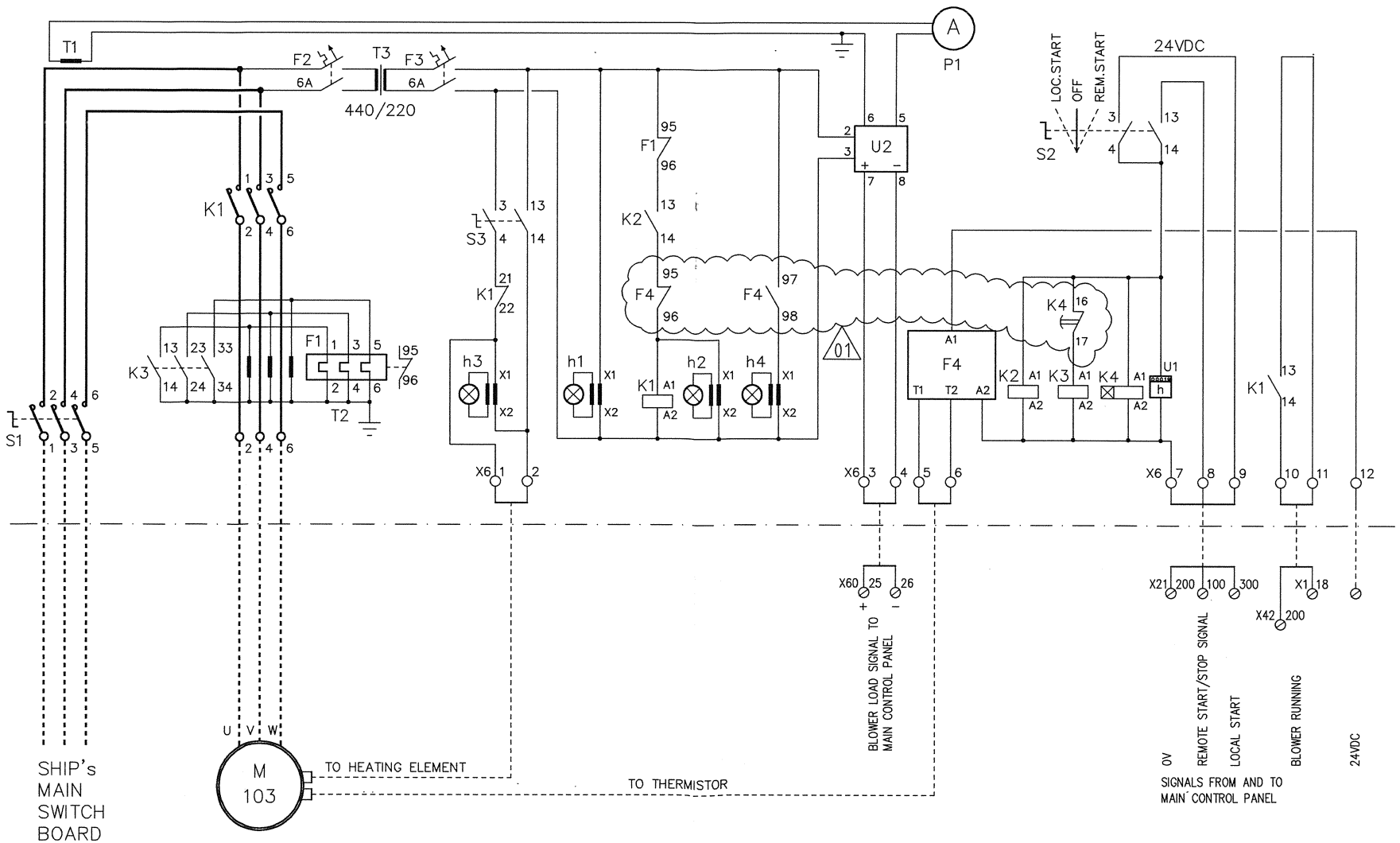
MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
STARTER BLOWER 1
ITEM 241

Erstn. for Replaces | Erstattet av Replaced by

130959-127-01 Rev. 03

Side Sheet 1 av of 2 sider sheets | Format A3



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01	20070531/	UPDATED.
00	20061129/LON.	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

MEG. Utf.sign. Issuer sign.

DUNQNAT S.Y. H 8239 Bestiller Purchaser: Hamworthy Moss AS

130959 Ordre nr. Order No.

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

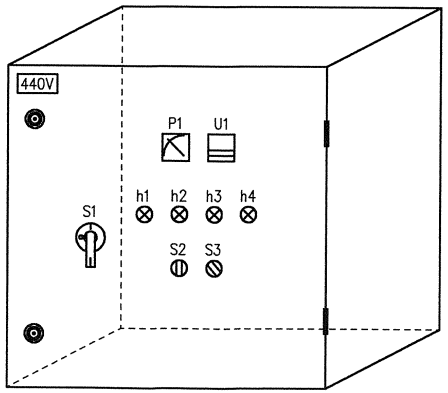
Erstn. for Replaces | Erstattet av Replaced by

Title: FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
STARTER BLOWER 1
CIRCUIT DIAGRAM

130959-127-02 | Rev. 01

Side Sheet 2 av of 2 sider sheets | Format A3

CLASSIFICATION :	ABS
WITNESS REQUIRED :	NO
SERIAL NO. :	6294



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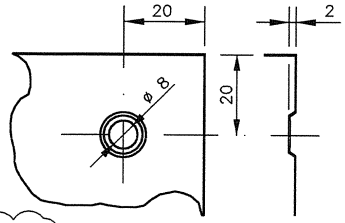
W = 600 mm
H = 600 mm
D = 210 mm



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.

03 COLOUR: MUNSELL 7,5 BG 7/2
~~WEIGHT: 80 KG~~
ENCLOSURE: IP44

h1 : POWER ON
h2 : RUNNING
h3 : HEATER ON
h4 : THERMISTOR ALARM

Qty.	Pos no.	Function	Make	Description
1		ENCLOSURE	RITTAL	AE 1060.500
1	S1	ISOLATION SWITCH	ABB	OT160E3+OTS160T3+OHB2AJ+OXP6x210
1	S2	SELECTOR SWITCH	Telemec	ZB2-BD3+ZB2-BZ103
1	S3	SWITCH	Telemec	ZB2-BD2+ZB2-BZ101+ZB2-BE101
1	K1	CONTACTOR	Siemens	3TF52 22-0X N2 (90KW / 210A)
2	K2, K3	RELAY	Telemec	CAD32-BD
1	K4	TIME DELAY RELAY	Telemec	RE7YR12BU
1	F1	OVERLOAD RELAY	Telemec	LRD-05C (0.63-1A)
2	F2, F3	CIRCUIT BREAKER	MG	C65HD206
1	F4	THERMISTOR RELAY	Telemec	LT3-SM00ED
1	P1	AMPERE-METER	Sunrise	BE-48 150/5A (IN MARKED RED)
1	h1	INDICATING LAMP	Telemec	XB2-BVM1LC WHITE
1	h2	INDICATING LAMP	Telemec	XB2-BVM3LC GREEN
1	h3	INDICATING LAMP	Telemec	XB2-BVM6LC BLUE
1	h4	INDICATING LAMP	Telemec	XB2-BVM4LC RED
1	T1	CURRENT TRANSFORMER	Sunrise	MFO-30 150/5A
3	T2	CURRENT TRANSFORMER	Sunrise	MFO-30 150/1A
1	T3	TRANSFORMER	Hongqi	440/220 400VA
1	U1	HOUR COUNTER	DEIF	HC48 24VDC IP65
1	U2	CURRENT TRANSDUCER	DEIF	TAC-311DG 0-5A/220VAC

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Rev.	Dato Sign.	Forandringer
03	20070717/	COLOUR WAS RAL 7035.
02	20070531/LON.	K4 WAS RE7RB11MW.
01	20070504/LON.	F1 WAS LR2-D1305.
00	20061129/LON.	

MEG — Uts.sign. Issuer sign.
DUNQNAT S.Y. H 8239 — Bestiller Purchaser
130959 — Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

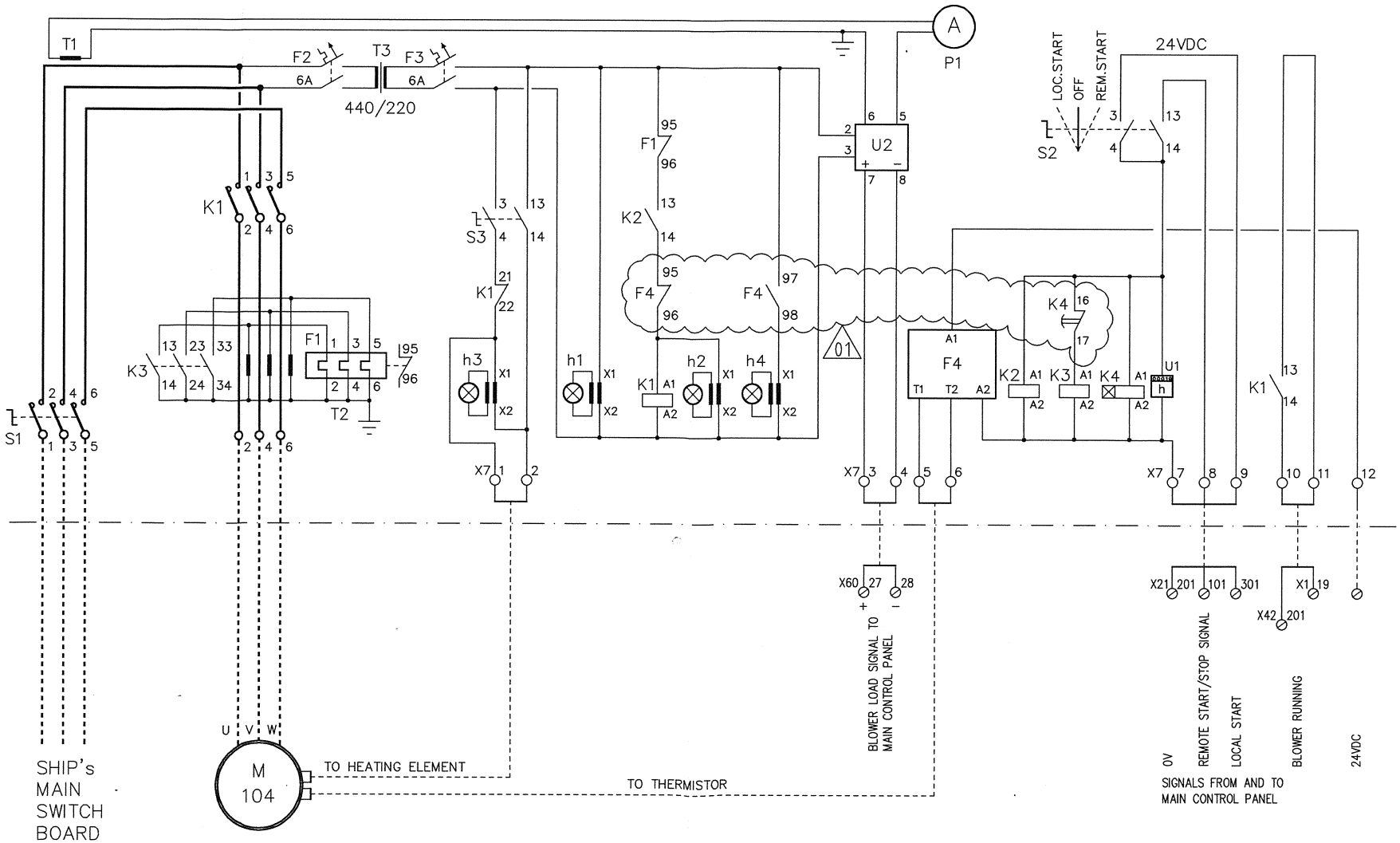
MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
STARTER BLOWER 2
ITEM 242

Erstn. for Replaces | Erstattet av Replaced by

130959-128-01 | Rev. 03

Side Sheet 1 av of 2 sider sheets | Format A3



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Rev.	Dato Sign.	Forandringer
01	20070531/	UPDATED.
00	20061129/LON.	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

MEG. Utf.sign. Issuer sign.

DUNQNAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

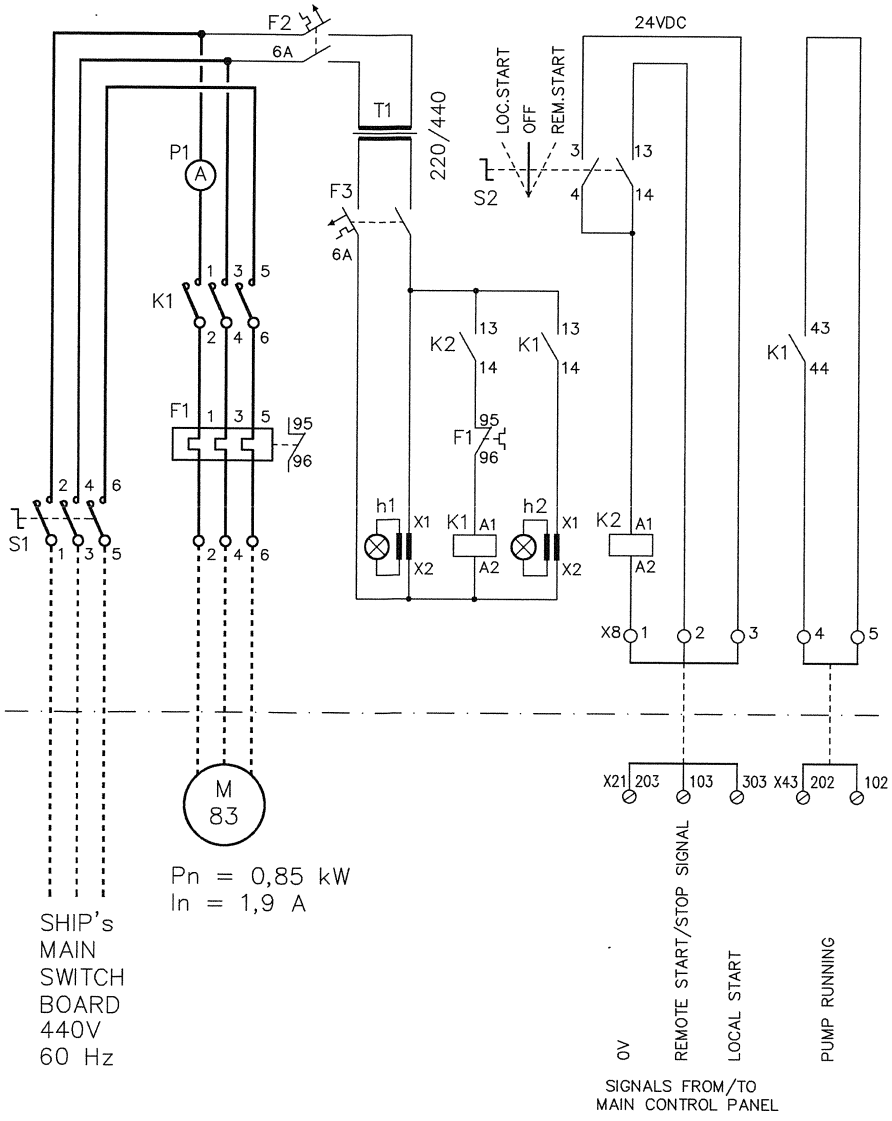
Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR STARTER BLOWER 2 CIRCUIT DIAGRAM

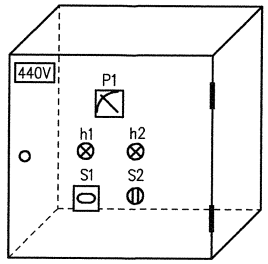
Erstn. for Replaces:

Erstattet av Replaced by:

130959-128-02 Rev. 01

Side Sheet 2 av of 2 sider sheets | Format A3





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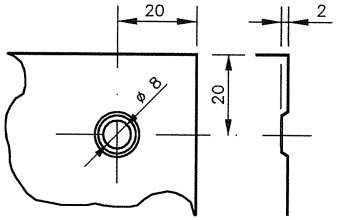
W = 380 mm
H = 380 mm
D = 210 mm



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.
3 OFF M25

02 COLOUR: MUNSELL 7,5 BG 7/2
WEIGHT: 15 KG
ENCLOSURE: IP44

Qty.	Pos. no.	Description	Make	Type
1		ENCLOSURE PANEL	RITTAL	AE 1380.500
1	S1	ISOLATION SWITCH	ABB	OT63E3+OTS63T3+OHB2AJ+OXS5x180
1	S2	SELECTOR SWITCH	Telemec	ZB2-BD3+ZB2-BZ103
1	K1	CONTACTOR	Telemec.	LC1-D09M7C+LADN20
1	K2	RELAY	Telemec.	CAD32-BD
1	F1	OVERLOAD RELAY	Telemec.	LRD-07C (1,6-2,5A)
2	F2, F3	CIRCUIT BRAEKER	MG	C65HD206
1	P1	AMPEREMETER	Sunrise	BE-48 0-5A (IN MARKED RED)
1	h 1	INDICATING LAMP	Telemec	XB2-BVM1LC WHITE
1	h 2	INDICATING LAMP	Telemec	XB2-BVM3LC GREEN
1	T1	TRANSFORMER	Honggi	440/220 90VA

h1 : POWER ON
h2 : RUNNING

CLASSIFICATION :	ABS
WITNESS REQUIRED :	NO
SERIAL NO. :	6294

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Rev.	Dato Sign.	Forandringer
02	20070717/	COLOUR WAS RAL 7035.
01	20070504/LON.	K1 WAS LC1-D0901M7+LA1DN20 AND F1 WAS LR2-D1307.
00	20061129/LON.	

MEG. Utf.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JGO	ET	

Proj.metode Proj.method

Hamworthy Moss AS

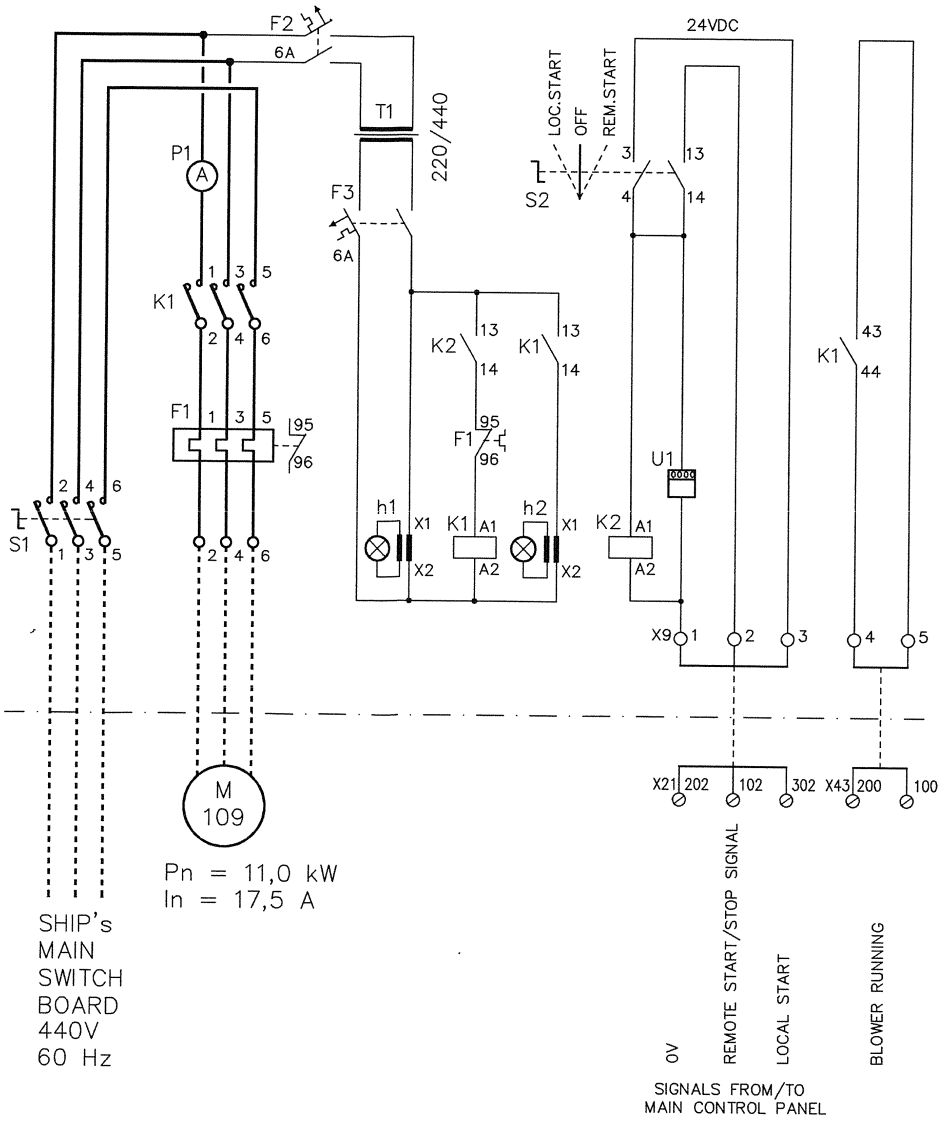
MOSS INERT GAS SYSTEM

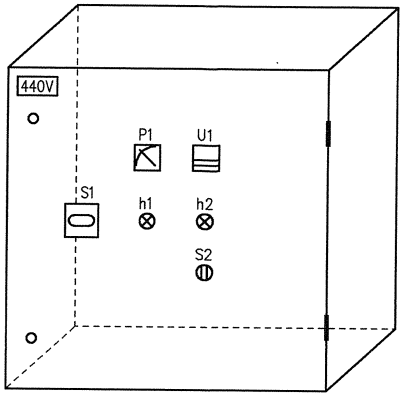
Title FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
STARTER FUEL OIL PUMP
ITEM 243-G

Erstn. for Replaces | Erstattet av Replaced by

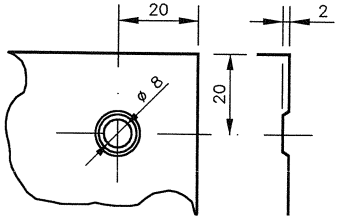
130959-133-01 Rev. 02

Side Sheet 1 av of 1 sider sheets | Format A3





DIMENSIONS :
W = 600 mm
H = 600 mm
D = 210 mm



4 off FIXING HOLE ON THE PANEL REAR, FOR SURFACE MOUNTING.
CABLE ENTRY THROUGH BOTTOM OF PANEL.
3 OFF M25

03 COLOUR: MUNSELL 7,5 BG 7/2
WEIGHT: 40 KG
ENCLOSURE: IP44

Qty.	Pos. no.	Description	Make	Type
1		ENCLOSURE PANEL	RITTAL	AE 1060.500
1	S1	ISOLATION SWITCH	ABB	OT63E3+OTS63T3+OHB2AJ+OXS5x180
1	S2	SELECTOR SWITCH	Telemec	ZB2-BD3+ZB2-BZ103
1	K1	CONTACTOR	Telemec.	LC1-D25M7C+LADN20
1	K2	RELAY	Telemec.	CAD32-BD
1	F1	OVERLOAD RELAY	Telemec.	LRD-22C (17-25A)
2	F2, F3	CIRCUIT BREAKER	MG	C65HD206
1	P1	AMPEREMETER	Sunrise	BE-48 0-25A (IN MARKED RED)
1	h 1	INDICATING LAMP	Telemec	XB2-BVM1LC WHITE
1	h 2	INDICATING LAMP	Telemec	XB2-BVM3LC GREEN
1	T1	TRANSFORMER	Hongqi	440/220 90VA
1	U1	HOUR COUNTER	Deif	HC48 24VDC IP65

h1 : POWER ON
h2 : RUNNING

CLASSIFICATION :	ABS
WITNESS REQUIRED :	NO
SERIAL NO. :	6294

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Rev.	Dato Sign.	Forandringer
03	20070717/	COLOUR WAS RAL 7035.
02	20070531/LON.	F1 WAS LRD-3322C.
01	20070504/LON.	K1 WAS LC1-D2501M7+LA1DN20 AND F1 WAS LR2-D1322.
00	20061129/LON.	

MEG. Uts.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.	JGÖ	ET	

Proj.metode Proj.method

Hamworthy Moss AS

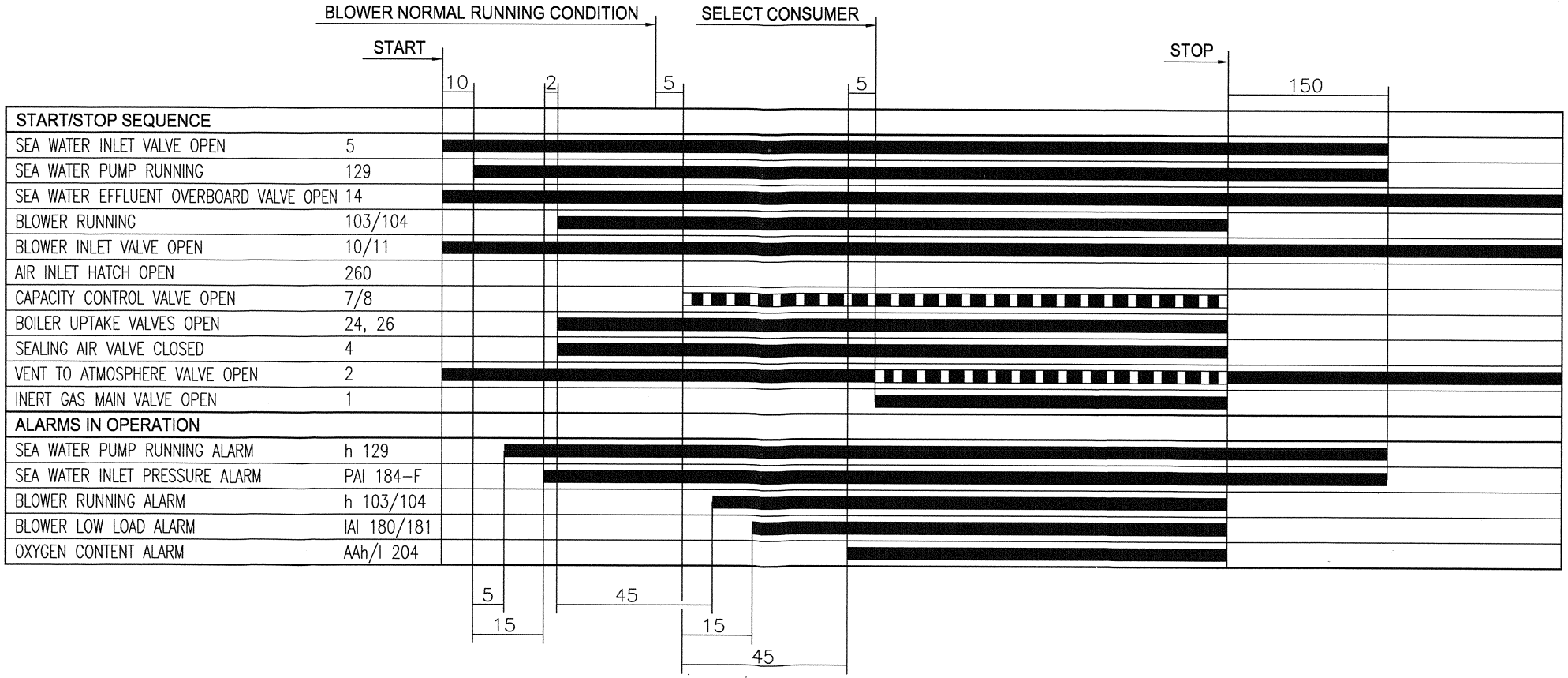
MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM
+ TOPPING UP GENERATOR
STARTER GENERATOR BLOWER
ITEM 241-G

Erstn. for Replaces | Erstattet av Replaced by

130959-138-01 | Rev. 03

Side Sheet 1 av of 1 sider sheets | Format A3



NOTE ! INDICATED TIMES – IN SECONDS.

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Rev.	Dato Sign.	Forandringer
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Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR

PROGRAM CONTROL TIME SEQUENCE FLUE GAS MODE

Erstn. for Replaces | Erstattet av Replaced by

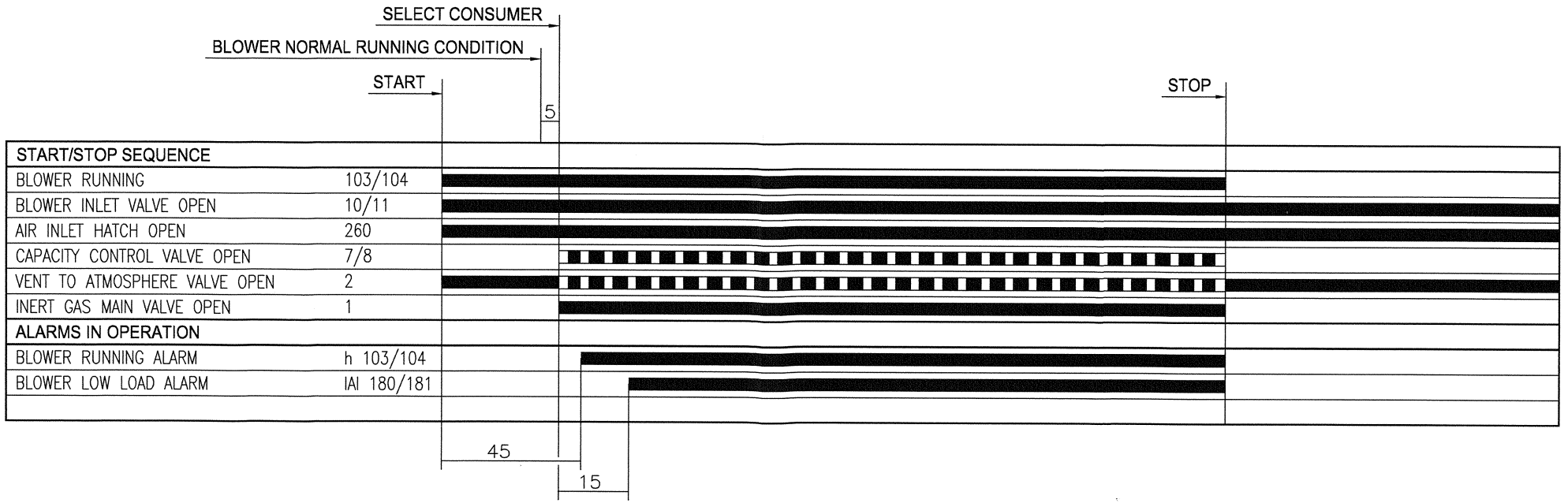
130959-150-01 | Rev. 00

Side Sheet 1 av of 3 sider sheets | Format A3

Uts.sign. Issuer sign. MEG.

Bestiller Purchaser DUNQNAT S.Y. H 8239

Ordre nr. Order No. 130959



NOTE : INDICATED TIMES – IN SECONDS.

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Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode / Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR

PROGRAM CONTROL TIME SEQUENCE AIR VENT MODE

Erstn. for / Replaces

Erstattet av / Replaced by

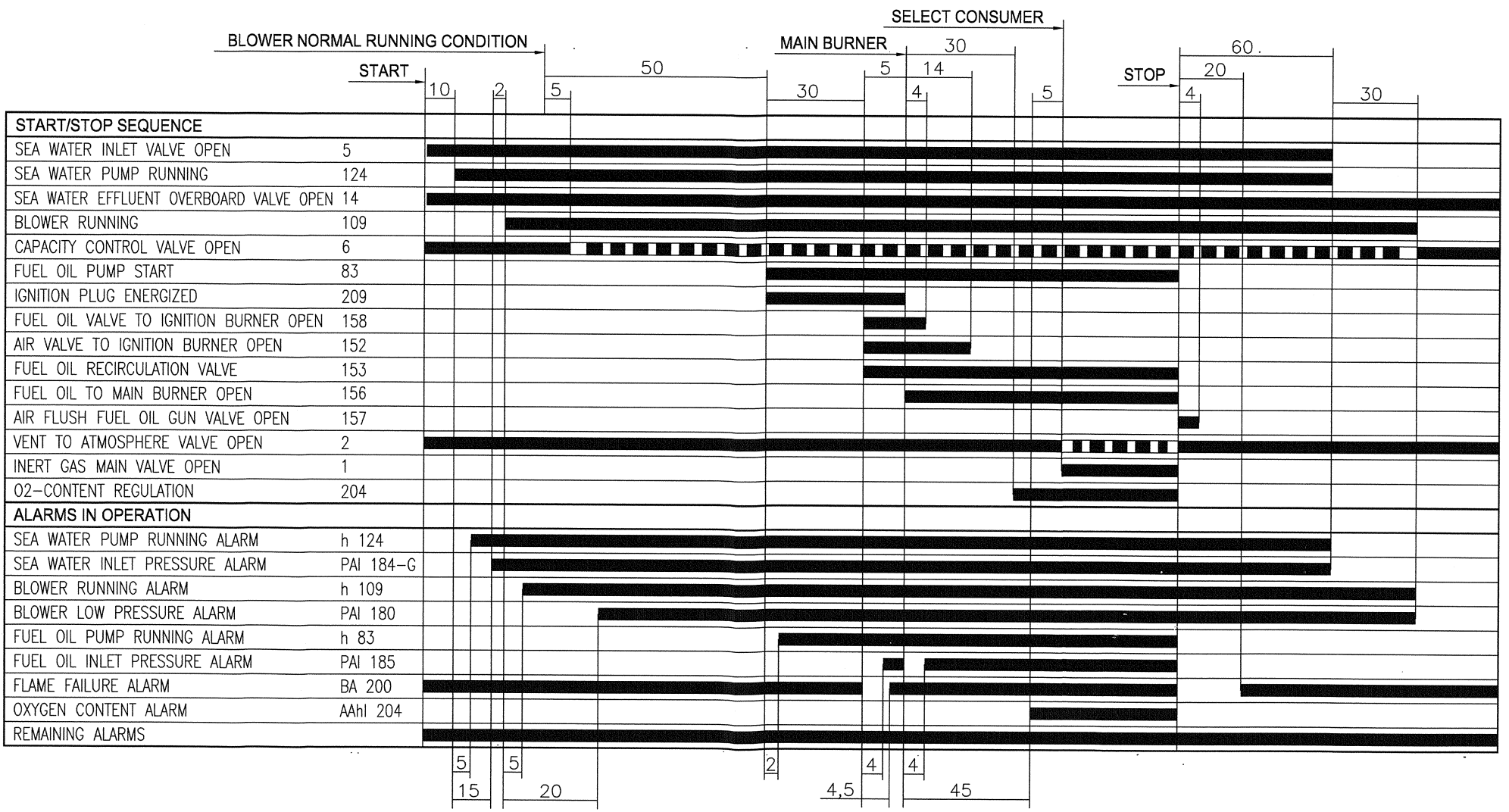
130959-150-02 Rev. 00

Side / Sheet 2 av / of 3 sider / sheets Format A3

Uts.sign. / Issuer sign. MEG.

Bestiller / Purchaser DUNQNAT S.Y. H 8239

Ordre nr. / Order No. 130959



START/STOP SEQUENCE	
SEA WATER INLET VALVE OPEN	5
SEA WATER PUMP RUNNING	124
SEA WATER EFFLUENT OVERBOARD VALVE OPEN	14
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FUEL OIL INLET PRESSURE ALARM	PAI 185
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NOTE ! INDICATED TIMES – IN SECONDS.

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DUNQNAT S.Y. H 8239 Bestiller Purchaser

130959 Ordre nr. Order No.

Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode Proj.method

Hamworthy Moss AS

MOSS INERT GAS SYSTEM

Title FLUE GAS SYSTEM + TOPPING UP GENERATOR

PROGRAM CONTROL TIME SEQUENCE TG MODE

Erstn. for Replaces | Erstattet av Replaced by

130959-150-03 Rev. 00

Side Sheet 3 av of 3 sider sheets | Format A3

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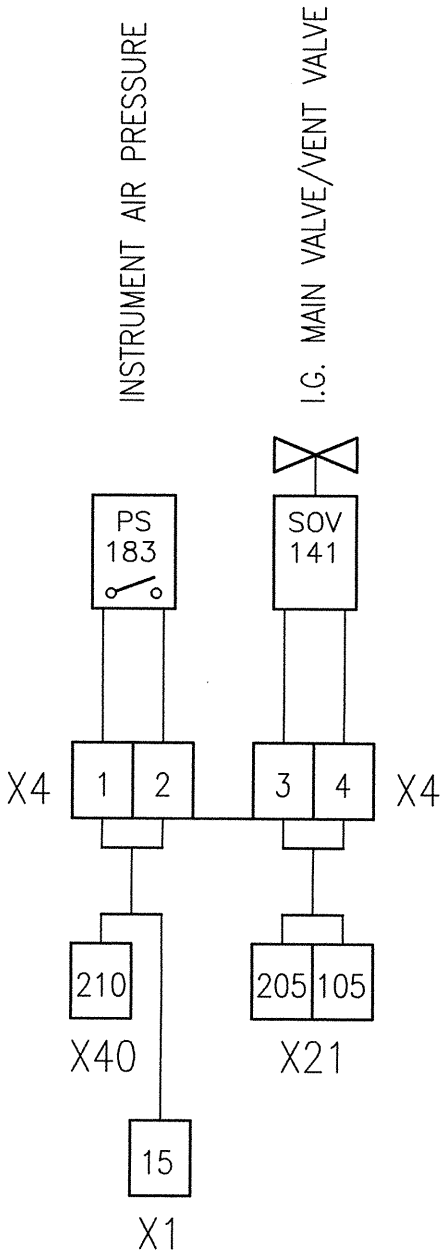


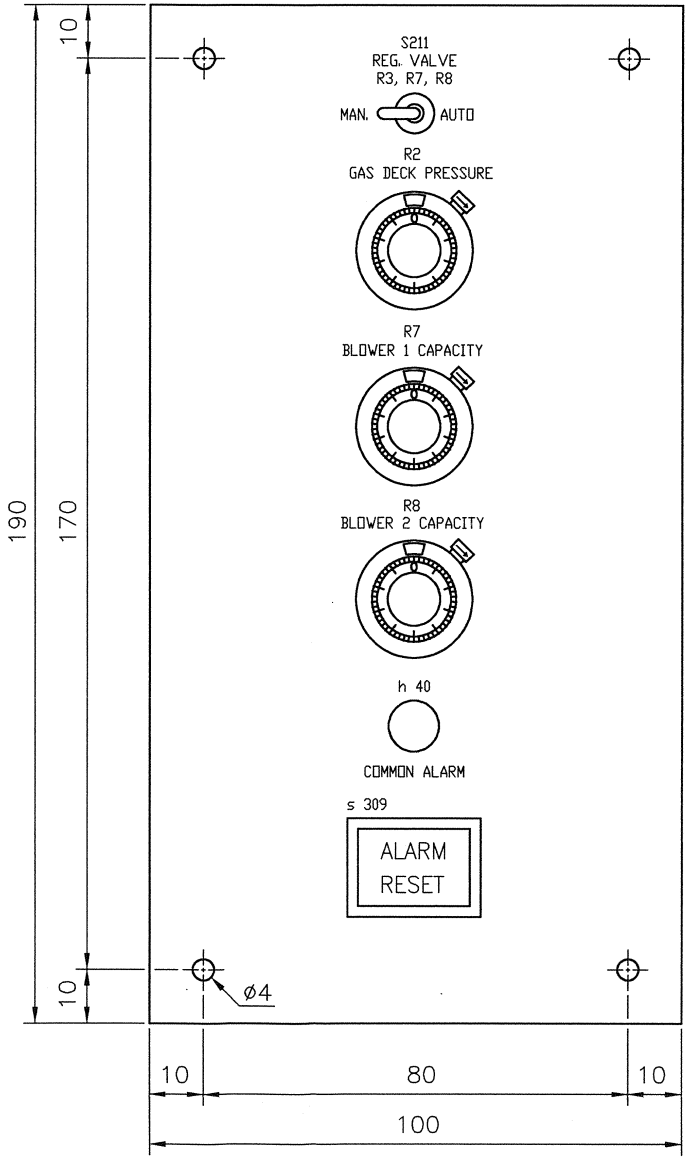
TERMINAL BOX TYPE : FISKARS MI 125/75 G

DIMENSIONS : H = 125 mm
W = 125 mm
D = 75 mm

Bygg nr. Yard No: DUNQNAT S.Y. H 8239	Ordre nr. Order No.: 130959	Tegn. Drawn	Tracet Traced: BT.	Kontr. Checked	Godkj. App'd.: ET	Dato Date: 20061129	Skala Scale	Gruppe nr. Group. No.: 6400

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replacec	Erstattet av Replaced by
Hamworthy Moss AS	Title: FLUE GAS SYSTEM + TOPPING UP GENERATOR TERMINAL BOX X4 AND CONNECTIONS ON PNEUMATIC PANEL ITEM 231	130959-152-01	Rev. 00
		Side Sheet 1 av of 1 sider sheets	Format A4

Forandringer: REV 00) 20061129/



MANUAL OVERRIDE OPERATION

ONLY TO BE REMOVED
UPON EMERGENCY

FRONT PLATE

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Rev.	Dato Sign.	Forandringer
00	20061129/	

Gruppe nr. Group No.	Dato Date	Tegnet Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Skala Scale
6400	20061129		BT.		ET	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replaces	Erstattet av Replaced by
Hamworthy Moss AS	Title FLUE GAS SYSTEM +TOPPING UP GENERATOR MAIN CONTROL PANEL MANUAL OVERRIDE	130959-156-01	Rev. 00
		Side Sheet 1 av of 1 sider sheets	Format A3

MEG. Utf.sign. Issuer sign.
DUNQNAT S.Y. H 8239 Bestiller Purchaser
130959 Ordre nr. Order No.

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Hamworthy Moss AS

Part no: M5606-001txt

FG: Item: 2,4,5,7,8, 10,11,47,48

Rev: 02

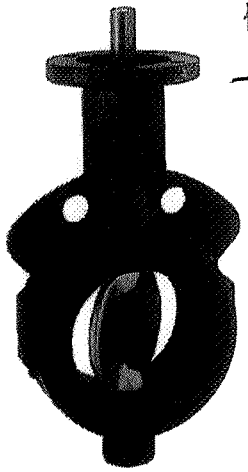
Date: 20050608

FG: 5,6,50

BUTTERFLY VALVES

Fig. 14

User manual



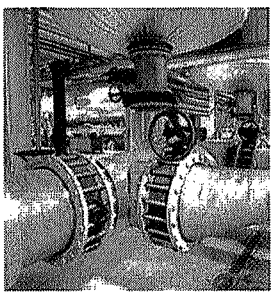
The Figure 14 has a one piece disc stem, a field replaceable seat and a wide range of material combinations to meet most severe applications

Features

- Actuator fluator flange acc. ISO 5211.
- Top bushing absorbs actuator side thrust loads.
- The extended body neck allows pipeinsulation.
- Body locating holes provide easy installation and a perfect centering of the valve between the flanges.
- Wafer type split-body design specified acc. ISO 5752/5 short. (DIN 3202, Part 3/K1)
- The one-piece wafer thin disc stem provides the very minimum obstruction to flow.
- Rounded, polished disc edge gives full concentric sealing, lower torques, longer seat life and bubble-tight shut-off.
- Primary stem sealing by preloaded contact between flatted seat surface and rounded polished disc-hub area exceeds the pressure rating of the valve and prevents leakage through shaft area to atmosphere.
- A secondary sealing is provided by the interference fit between shaft and shafthole in seat at all positions.
- A molded-in O-ring provides flange sealing and eliminates need for gaskets.
- The seat is field replaceable and fully isolates the body and stem from the flow.
- Dirtscraper prevents moisture penetrating into the shaft area

Technical data	
Pressure	10 - 16 bar
Temperature	-40 +160 °C
Size	40-300mm
Flange accommodation	PN 10/16 ANSI 150

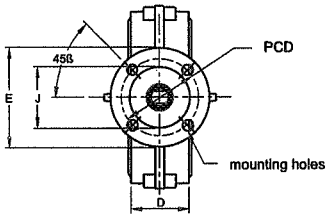
General application

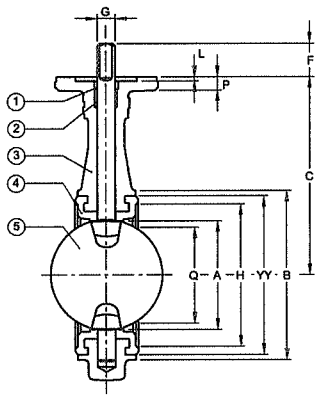


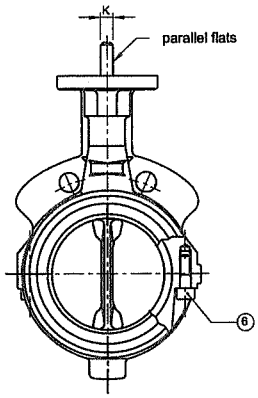
Food and beverage processing, dry bulk conveying, paper mills, slurry handling etc. These valves are for any service where a bubble-tight shut-off with maximum flow area is required. It has smooth flow characteristics, abrasion, erosion and corrosion resistance and a crevice free internal contour. For drinking water applications a certified EPDM compound available. Grease or silicone free valves available for special applications such as paint or oxygen systems. Figure 14 with PTFE lined seat is ideally suited to applications where excellent chemical resistance and non-toxic properties are required, as are commonly encountered in the chemical, petrochemical and pharmaceutical industries.

Hamworthy Moss AS

Part no: M5606-001txt Item:







Part name	
1	Dirtscraper
2	Shaft bushing
3	Body
4	Seat
5	Disc-stem
6	Body screws

Valve dimensions in mm

Size	A	B	C	D	H	Q	YY	Shaft dimensions F	Gh9	K $^{0}_{-0.05}$	Actuator flange acc. ISO 5211/1 Type	E	J	L	P	PCD	ø Hole	Mass (kg)
40	40	78	130	33	49	24	64	25	12	8	F-05	65	35	4	9	50	6,6	1,5
50	50	94	135	43	66	27	80	25	12	8	F-05	65	35	4	9	50	6,6	2,1
65	62	109	150	46	78	43	93	30	16	11	F-07	90	55	4	12	70	9,5	3,2
80	78	126	160	46	97	64	112	30	16	11	F-07	90	55	4	12	70	9,6	3,6
100	99	156	180	52	129	87	144	30	16	11	F-07	90	55	4	12	70	9,4	5,2
125	124	189	195	56	160	113	175	30	20	14	F-07	90	55	4	12	70	9,4	7,6
150	151	214	210	56	181	141	196	30	20	14	F-07	90	55	4	12	70	9,4	8,5
200	195	267	240	60	233	188	248	50	25	18	F-12	150	85	4	18	125	13,5	16,0
250	245	321	275	68	290	237	305	50	30	22	F-12	150	85	4	18	125	13,5	23,5
300	292	375	310	78	340	283	355	50	30	22	F-12	150	85	4	18	125	13,5	32,0

Actuator selection

Acturator type	Figure	Remark
Handle	F412	Leverlock
	F413	Continuous adjustable
Gear	F455	-
Pneumatic	F79E	-
Gear/Pneumatic	F454/79E	Declutchable gearunit provides manual override for the pneumatic actuator
Electric	F778	-

Maximum differential pressure (bar)

Type	Pressure	Remark
All materials except the following:	16	
Cast Iron body	10	
	16	Only for limited size range
EPDM covered disc	10	
Titanium disc	10	
Fluorel seat	16	Contact factory
PTFE lined seat	6 bar 150°C 10 bar 130°C 16 bar 120°C	

Note

1 Rated K_V = the volume of water in m^3/hr that will pass through a given valve opening at a pressure drop of 1bar.

K_V values										
Disc opening	Size in mm									
	40	50	65	80	100	125	150	200	250	300
10°	-	-	-	-	-	-	-	-	19,5	47,3
15°	0,1	0,19	0,6	1,7	2,3	4,1	5,4	13,1	77,8	182
20°	0,6	0,9	2,4	5,0	9,2	14,8	22,4	53	151	314
25°	1,9	2,9	5,9	11,2	21,1	36,7	59	121	218	343
30°	3,8	5,9	11,1	20,4	37,6	66,8	108	204	300	369
35°	6,2	9,6	17,8	32,4	58,6	102	161	293	419	504
40°	9,2	14,3	26,2	47,4	84,8	143	221	392	572	718
45°	13,1	20,5	36,8	65,8	117	193	293	511	749	955
50°	18,1	28,3	49,7	87,9	154	254	381	657	956	1212
55°	24,4	38,2	65,7	115	200	327	489	835	1207	1521
60°	33,5	51,6	87,4	151	260	420	621	1050	1540	1993
65°	45,8	69,4	117	202	346	547	794	1320	1999	2717
70°	54,2	88,6	156	274	471	743	1062	1731	2628	3624
75°	57,0	106	202	369	641	1025	1459	2348	3509	4777
80°	57,6	111	232	442	789	1261	1802	2946	4616	6613
85°	58,5	111	245	486	877	1410	1944	3526	6192	10148
90°	58,5	112	249	492	895	1444	2099	3715	6883	11343

Note

1 The given maximum allowable shaft torques are applicable for standard type valves.

2 In ISO 5211/2 a table is listed representing the maximum torques which can be transmitted through the mounting flange. These values are based upon specific criteria and can be lower than the maximum allowable shaft torques. In this case the criteria can be changed in order to reach the maximum allowable shaft torques.

Maximum allowable shaft torques in Nm										
shaft mat.	Size in mm									
	40	50	65	80	100	125	150	200	250	300
SS	65	65	160	160	160	320	320	545	970	970
C.45	75	75	180	180	180	305	305	620	1100	1100
Titanium	45	45	105	105	105	210	210	430	760	760

Note

1 Dynamic operating torque formula:
$T_D = F_T \times \Delta P$
T_D = Dynamic torque (Nm)
ΔP = Pressure drop across disc at desired disc-opening (bar)
F_T = Dynamic torque factor (see table)

2 The above mentioned dynamic torque includes all frictional resistances.

3 The dynamic torque is tendig to close the disc.

Dynamic torque factors FT for metric units

Disc opening	Size in mm									
	40	50	65	80	100	125	150	200	250	300
10°	-	-	-	-	-	-	-	-	4,7	8,1
15°	-	0,1	0,1	0,3	0,5	1,0	1,7	4,0	7,8	13,5
20°	0,1	0,1	0,2	0,5	0,9	1,8	3,0	7,2	14,1	24,3
25°	0,1	0,2	0,4	0,7	1,4	2,7	4,7	11,2	21,9	37,8
30°	0,1	0,3	0,6	1,1	2,1	4,1	7,1	16,8	32,8	56,7
35°	0,2	0,4	0,8	1,5	3,0	5,9	10,1	24,0	46,9	81,0
40°	0,3	0,5	1,1	2,1	4,1	8,0	13,8	32,8	64,1	110,7
45°	0,3	0,7	1,5	2,8	5,4	10,5	18,2	43,2	84,4	145,8
50°	0,4	0,9	1,9	3,6	7,0	13,7	23,6	56,0	109,4	189,0
55°	0,6	1,1	2,5	4,6	9,0	17,6	30,4	72,0	140,6	243,0
60°	0,8	1,5	3,3	6,1	12,0	23,4	40,5	96,0	187,5	324,0
65°	1,0	1,9	4,1	7,7	15,0	29,3	50,6	120,0	234,4	405,0
70°	1,3	2,5	5,5	10,2	20,0	39,1	67,5	160,0	312,5	540,0
75°	1,7	3,4	7,4	13,8	27,0	52,7	91,1	216	421,9	729,0
80°	2,0	3,9	8,5	15,9	31,0	60,5	104,6	248,0	484,4	837,0
85°	1,3	2,5	5,5	10,2	20,0	39,1	67,5	160,0	312,5	540,0
90°	-	-	-	-	-	-	-	-	-	-

Note

1 Application I:
Water, seawater, lubricating types of hydrocarbons. Temp.: 0-80°C. Valve opens at least once a month.

Application II:
All other liquid applications and lubricating gasses.

Application III:
Non lubricating and dry media.

2 The charted maximum sizing operating torque is the sum of all friction and resistance for opening and closing of the disc against the indicated pressure differential.

3 The effect of dynamic torque is not considered in tabulation.

4 In sizing operators it is not necessary to include safety-factors.

Sizing torque in Nm

ΔP in bar	Size in mm									
	40	50	65	80	100	125	150	200	250	300
Application I										
3,5	10	13	19	26	37	58	81	148	241	345
7	10	13	20	27	40	63	88	164	271	387
10	11	14	21	30	44	70	99	188	315	451
14	11	15	23	33	49	80	113	219	374	536
16	12	15	25	36	51	85	120	235	403	578
Application II										
3,5	11	14	21	29	42	66	93	169	274	392
7	11	14	22	31	45	71	100	185	303	434
10	11	15	23	33	49	78	111	208	347	498
14	12	16	26	36	54	88	125	240	406	583
16	12	17	27	38	56	93	132	255	436	626
Application III										
3,5	12	15	23	32	48	74	105	190	306	439
7	12	16	24	34	50	79	112	206	336	481
10	12	16	26	36	54	86	122	229	380	545
14	13	17	28	40	59	96	136	261	439	629
16	13	18	29	41	61	101	143	276	468	672

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Part no: M5635-001txt FG: Item: 1,

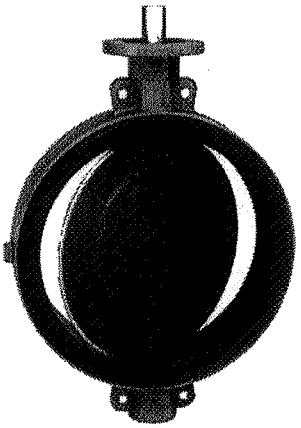
Rev: 02

Date: 20050608

BUTTERFLY VALVES

Fig. 15

User manual



The Figure 15 offers a wide range of material combinations for those applications where large diameter valves are considered.

Features

- Actuator flange acc. ISO 5211.
- Top bushing absorbs actuator side thrust loads.
- The extended body neck allows pipe insulation.
- Body locating holes provide ease installation and a perfect centering of the valve between the flanges.
- Wafer type body design acc. ISO 5752/5 short. (DIN 3202, Part 3/K1)
- The thin disc provides the very minimum obstruction to flow.
- Rounded, polished disc edge gives full concentric sealing, lower torques, longer seat life and bubble-tight shut-off.
- Primary stem sealing by preloaded contact between flatted seat surface and rounded polished disc-hub area exceeds the pressure rating of the valve and prevents leakage through shaft area to atmosphere.
- A secondary sealing is provided by the interference fit between shaft and shafthole in seat at all positions.
- A molded-in O-ring provides flange sealing and eliminates need for gaskets.
- The seat is field replaceable and isolates the body and stem from the flow.
- Dirtscraper prevents moisture penetrating into the shaft area.

Technical data	
Pressure	10 bar
Temperature	-40 +120°C
Size	350-900mm
Flange accommodation	PN 10/16 ANSI 150 Others on request

General application

Food and beverage processing, dry bulk conveying, paper mills, slurry handling etc. These valves are for any service where a bubble-tight shut-off with maximum flow area is required. It has smooth flow characteristics, abrasion, erosion and corrosion resistance and a crevice free internal contour.

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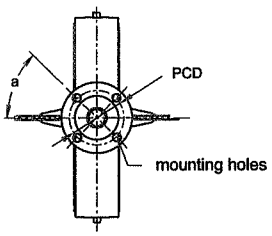
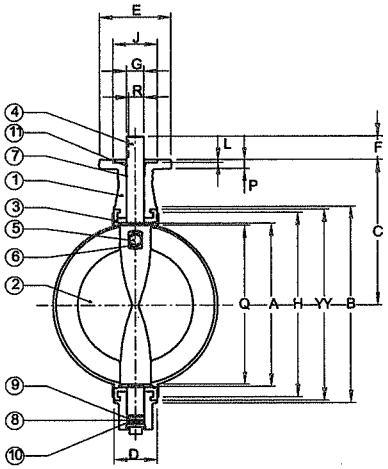
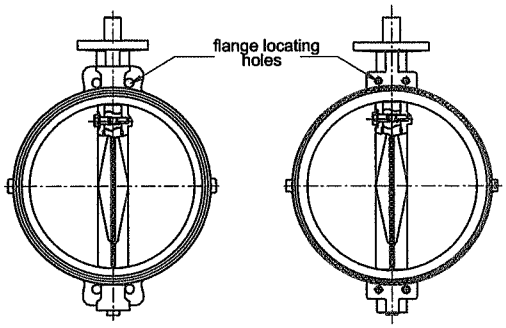




Part name			
1	Body	7	Bushing
2	Disc	8	Plug
3	Seat	9	O-ring
4	Shaft	10	Circlip
5	Disc-screw	11	Dirt scraper
6	O-ring		



sizes 350-600 mm

sizes 700-900 mm

Valve dimensions in mm

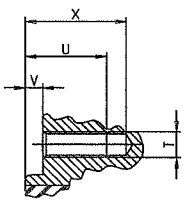
Size	A	B	C	D	H	YY	Q	Shaft dimensions F	Gh9	R	Keysize width x height	Actuator flange acc. ISO 5211/1 Type	E	J	L	P	PCD	ø Hole	No. Holes	a(*)	Mass (kg)
350	325	413	325	78	378	398	319	70	35	30,0	10 x 8	F12	150	85	4	18	125	13.5	4	45.0	42
400	380	470	360	102	435	455	369	70	40	35,0	12 x 8	F16	210	130	6	25	165	22.0	4	45.0	64
450	434	530	395	114	495	515	422	70	40	35,0	12 x 8	F16	210	130	6	25	165	22.0	4	45.0	85
500	486	584	430	127	549	569	472	70	50	44,5	14 x 9	F16	210	130	6	25	165	22.0	4	45.0	107
600	585	685	500	154	650	670	569	70	50	44,5	14 x 9	F16	210	130	6	25	165	22.0	4	45.0	147
700	685	795	570	165	755	775	669	100	70	62,5	20 x 12	F25	300	200	6	30	254	17.5	8	22.5	247
750	735	855	605	190	816	835	715	100	70	62,5	20 x 12	F25	300	200	6	30	254	17.5	8	22.5	300
800	785	900	640	190	860	880	766	100	70	62,5	20 x 12	F25	300	200	6	30	254	17.5	8	22.5	330
900	855	1000	715	203	960	980	865	100	80	71,0	22 x 14	F25	300	200	6	30	254	17.5	8	22.5	448

Actuator selection

Acturator type	Figure	Remark
Gear	F455	-
Pneumatic	F79E	-
Gear/Pneumatic	F454/79E	Declutchabel gearunit provides manual override for the keystone pneumatic actuator
Electric	F778	-

Dimensions of locating holes in mm

Size:		700	750	800	900
PN 10	T	M27	M30	M30	M30
	U	59.5	68.0	63.0	56.5
	V	22.5	30.0	25.0	6.5
	X	67.5	75.0	70.0	76.5
PN 16	T	M33	M33	M36	M36
	U	55.5	63.0	61.0	60.5
	V	22.5	30.0	25.0	6.5
	X	62.5	70.0	70.0	76.5



Part no: M5635-001txt Item:

Note

1 Rated K_V = the volume of water in m^3/hr that will pass through a given valve opening at a pressure drop of 1bar.

K_V values									
Disc opening	Size in mm								
	350	400	450	500	600	700	750	800	900
5°	51	66	84	104	149	203	234	266	336
10°	119	155	196	242	349	475	545	620	785
15°	220	288	364	450	648	887	1012	1151	1457
20°	304	397	503	621	894	1216	1396	1589	2011
25°	441	576	729	900	1295	1763	2024	2303	2915
30°	637	832	1053	1300	1871	2547	2924	3327	4211
35°	858	1121	1419	1752	2522	3433	3941	4484	5675
40°	1142	1492	1888	2331	3357	4569	5245	5968	7553
45°	1497	1956	2475	3056	4400	5989	6875	7822	9900
50°	1936	2529	3200	3951	5689	7744	8890	10114	12801
55°	2457	3209	4062	5015	7221	9829	11283	12838	16248
60°	3110	4062	5141	6347	9140	12440	14281	16248	20564
65°	3841	5017	6350	7839	11288	15365	17638	20068	25399
70°	5010	6544	8288	10224	14723	20040	23005	26174	33127
75°	6716	8772	11102	13706	19736	26864	30838	35087	44407
80°	8969	11714	14826	18303	26357	35875	41183	46857	59303
85°	9913	12947	16386	20230	29131	39651	45518	51789	65546
90°	10407	13592	17203	21238	30583	41626	47785	54369	68811

Note

1 The given maximum allowable shaft torques are applicable for standard type valves.

2 In ISO 5211/2 a table is listed representing the maximum torques which can be transmitted through the mounting flange. These values are based upon specific criteria and can be lower than the maximum allowable shaft torques. In this case the criteria can be changed in order to reach the maximum allowable shaft torques.

Maximum allowable shaft torques in Nm									
shaft mat.	Size in mm								
	350	400	450	500	600	700	750	800	900
stainless steel	1760	2012	3472	3858	6587	7685	8234	8782	8782
Carbon steel	1632	2012	3311	3858	6587	7685	8234	8782	8782

Part no: M5635-001txt Item:

Note

1 Dynamic operating torque formula:
$T_D = F_T \times \Delta P$
T_D = Dynamic torque (Nm)
ΔP = Pressure drop across disc at desired disc-opening (bar)
F_T = Dynamic torque factor (see table)

2 The above mentioned dynamic torque includes all frictional resistances.

Dynamic torque factors FT for metric units

Disc opening	Size in mm								
	350	400	450	500	600	700	750	800	900
5°	-	-	-	-	-	-	-	-	-
10°	-	-	-	-	-	-	-	-	-
15°	8,6	12,8	18,2	25,0	43,2	68,6	84,4	102,4	145,8
20°	21,4	32,0	45,6	62,5	108,0	171,5	210,9	256,0	364,5
25°	42,9	64,0	91,1	125,0	216,0	343,0	421,9	512,0	729,0
30°	64,3	96,0	136,7	187,5	324,0	514,5	632,8	768,0	1093,5
35°	94,3	140,8	200,5	275,0	475,2	754,6	928,1	1126,4	1603,8
40°	124,3	185,6	264,3	362,5	626,4	994,7	1223,4	1484,8	2114,1
45°	171,5	256,0	364,5	500,0	864,0	1372,0	1687,5	2048,0	2916,0
50°	235,8	352,0	501,2	687,5	1188,0	1886,5	2320,3	2816,0	4009,5
55°	321,6	480,0	683,4	937,5	1620,0	2572,5	3164,1	3840,0	5467,5
60°	415,9	620,8	883,9	1212,5	2095,2	3327,1	4092,2	4966,4	7071,3
65°	544,5	812,8	1157,3	1587,5	2743,2	4356,1	5357,8	6502,4	9258,3
70°	733,2	1094,4	1558,2	2137,5	3693,6	5865,3	7214,1	8755,2	12465,9
75°	1050,4	1568,0	2232,6	3062,5	5292,0	8403,5	10335,9	12544,0	17860,5
80°	1346,3	2009,6	2861,3	3925,0	6782,4	10770,2	13246,9	16076,8	22890,6
85°	913,2	1363,2	1941,0	2662,5	4600,8	7305,9	8985,9	10905,6	15527,7
90°	-	-	-	-	-	-	-	-	-

Note

1 Application I:
Water, seawater, lubricating types of hydrocarbons. Temp.: 0-80°C. Valve opens at least once a month.

Application II:
All other liquid applications and lubricating gasses.

Application III:
Non lubricating and dry media.

2 The charted maximum sizing operating torque is the sum of all friction and resistance for opening and closing of the disc against the indicated pressure differential.

3 The effect of dynamic torque is not considered in tabulation.

4 In sizing operators it is not necessary to include safety-factors.

Sizing torque in Nm

ΔP in bar	Size in mm								
	350	400	450	500	600	700	750	800	900
Application I									
3,5	492	672	889	1146	1789	2625	3123	3679	4654
7	559	773	1032	1342	2128	3164	3786	4482	5672
10	660	923	1247	1636	2637	3972	4779	5688	7198
Application II									
3,5	555	755	994	1276	1976	2880	3416	4011	5076
7	623	856	1138	1472	2315	3419	4078	4815	6093
10	724	1007	1352	1766	2824	4226	5072	6021	7619
Application III									
3,5	619	839	1100	1406	2163	3135	3708	4344	5497
7	686	939	1243	1602	2502	3673	4371	5148	6514
10	787	1090	1457	1896	3011	4481	5364	6354	8040

Hamworthy Moss AS

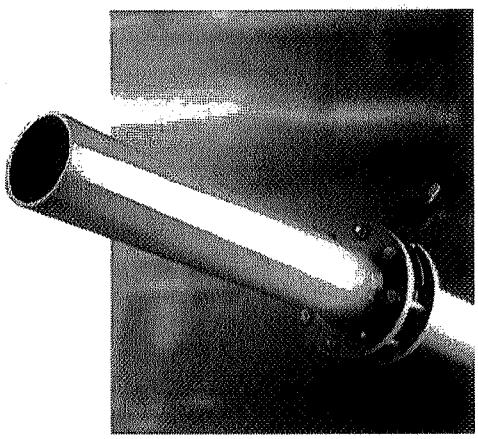
Part no: M5784-001txt Item:

Rev: 02 Date: 20050608

BUTTERFLY VALVES

Instructions

Installation and maintenance



Maintenance

Routine maintenance or lubrication is not required.

Removing the valve

1. Turn the disc to nearly closed position (The disc is in line with the parallel flats or keyway in the stem).
2. Loosen all flange bolts and remove the bolts which prevent removing the valve.
3. Spread the flanges with adequate tooling, and remove the valve.

Valve disassembly.

Figure 9-14-16-14 Plus 16 Plus

1. Turn the disc to almost open position.
2. Remove actuator.
3. Remove the two body-screws.
4. Remove the lower part of the body. This is more or less held by the seat dove-tail. Use two screwdrivers in the body-splits to separate them and pull the bottom-part off with a rotating motion.
5. Pull the disc-stem and seat out of the body toppart.
6. Remove bushing and packing from the top-part.
7. To remove the disc-stem from the seat, deform the seat into a long "oval" sufficient to clear the end of the short stem, move the short stem-end out of the seat-bore, and pull the long end from the seat stem hole, using a rotating motion.

Valve assembly.

Figure 9-14-16-14 Plus 16 Plus

1. Clean all parts. If possible use silicone-grease on the disc-stem to facilitate the assembly. If the valve has to be provided with a TFE-lined-seat preheat this seat during half an hour in nearly boiling water to ease assembly.
2. Insert the long stem-end of the disc-stem into a seat stem-hole using a twisting motion.
3. Deform the seat into a long "oval" sufficient to clear the end of the short stem. With the disc-stem simulating an open position, move the short stem-end into the elongated seat-bore and assemble the short stem-end into the other seat stem-hole by releasing the distorted seat. Do not put oil or grease between body and seat.
4. Push the long stem-end of the disc-stem/ seat unit into the body toppart. Push the seat dove-tail in place.
5. Assemble the packing and bushing.
6. Assemble the bottom part of the body. Over one body split a little rectangular is casted which indicates in which position the bottom part has to be mounted. Install the body screws and tighten securely. Take care that body parts are aligned completely.

Valve disassembly.

Figure 15-17

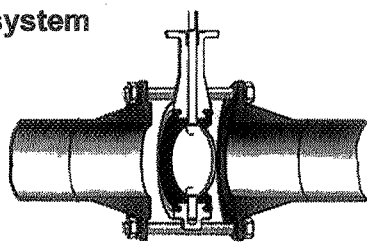
1. Turn the disc to almost open position.
2. Remove actuator.
3. Remove disc-screws with o-rings.
4. Pull the shaft out of the body.
5. Remove the disc by pulling or "rolling" out of the seat bore.
6. Remove bushing and packing of the body.
7. Remove the seat from the body, pry under both seat edges at one point, collapse the seat into the shape of a round bottom heart configuration and pull the seat out of the body bore.

Valve assembly.

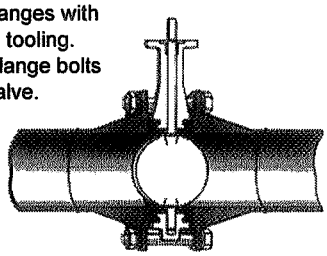
Figure 15-17

1. Clean all parts. If possible use only silicone-grease on the disc-stem to facilitate assembly. Do not put oil or grease between body and seat.
2. Collaps the seat in the shape of a round bottom heart configuration firmly place the "bottom" part of the seat into position. Take care to align properly the stem-holes.
3. Install the packing and the bushing.
4. Insert the shaft so far that it protrudes approx. 10 mm in the inside bore of the seat. Install the disc, with the disc-screw holes toward the topplate, by inserting the disc in the seat with the shaftbore on the topside against the shaft, leaving the bottompart of the disc just outside the seat. Push the bottom part of the disc in place with a twisting motion.
5. Insert the shaft completely using a rotating pressure on the shaft, and a rotating motion of the disc. Pay particular attention that the seat is not damaged due to any misalignment of the stem-holes.
6. Align the counter-drilled position of the stem screw holes. Place the o-rings on the disc screws. Install the disc-screws and tighten securely.

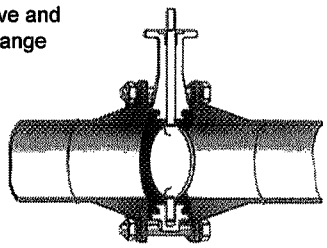
Existing system



1. Spread the flanges with the adequate tooling. Insert some flange bolts to bear the valve.

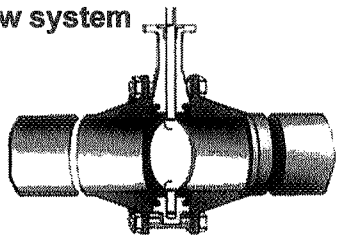


2. Open the valve and remove the flange spreads

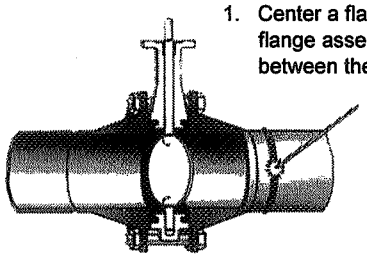


3. Close the valve clockwise, return to open position and cross-tighten all bolting.

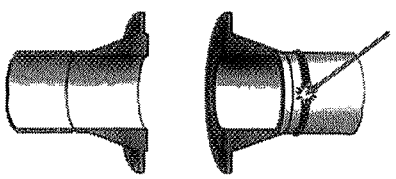
New system



1. Center a flange-valve-flange assembly between the pipes.



2. Tack-weld the flanges to the pipes.



3. Remove the valve and finish-weld. Install the valve according to the procedure in the left column.

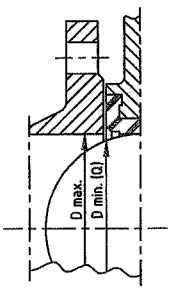
Flange and pipecompatibility

These butterfly valves are designed for use with the most common DIN and ANSI flange standards, as specified by the purchaser. Valves produced to meet installation requirements of one standard may not be suitable with another standard. Flanges have to meet the following requirements:

- The face diameter should be:

  D min.: The valve Q-dimension + adequate disc clearance.

  D max.: The inside diameter (ID) of standard pipe for the nominal size ISO 4200.



- If the flange (or pipe) is provided with a raised face, the diameter of this shall be at least 10 mm larger than the YY-dimension of the valve.
- The bolt pattern shall allow centering of the valve in the line either by the inscribed circle of the bolts touching the body-OD or by drilled holes in the lugs of the larger valves.
- The bolt-pattern must clear the hubs of the valve. The use of the flange-gaskets should be avoided since it might damage the valve. The seat-face design eliminates the need for the gaskets.

Installation in the pipe-line

These butterfly valves will control flow equally in either direction. The recommended installation-position is the shaft horizontal and the lower disc-edge opening down-stream. (Especially for slurry service and media with a tendency for sedimentation). A valve is no crow-bar. Do not use the valve to spread the flanges. Seatdamage during installation or in operation might be the result. Do not use flange gaskets! The valve can be installed in the pipe-line either with or without the actuator mounted on top of the valve. Make sure that you can turn the disc by hand so you can feel a mismatch, resulting in a disc touching the adjacent piping.

Installation in an existing system

1. Check whether the flange distance meets the valve face-to-face dimensions. Spread with adequate tooling the flanges for easy insertion of the valve.
2. Insert some flange-bolts in the flanges, to help you bear the valve after insertion.
3. Close the valve so far, that the disc-edge is at least 10 mm within the body.
4. Insert the valve between the flanges, center the valve body and insert all flange bolts.
5. Open the valve completely. (The disc is in line with the parallel flats or keyway in the stem.).
6. Maintain the valve to flange alignment while gradually removing the flange-spreaders and tightening the flange-bolts handtight.
7. Slowly close the valve clockwise to check for adequate disc clearance.
8. Return the disc to full open position and cross-tighten all bolting to the proper torque. If Figure 16 is used in an end-of-line service application, special attention is required while tightening the bolts.

Installation in a new system

1. With the disc in near-closed position center each mating flange with the valve body. Span the body with some flange-bolts and tighten the bolts.
2. Use the flange-valve-flange assembly for fit-up and centering to the pipe.
3. Tack-weld the flanges to the pipe.
4. Remove the bolting and the valve.

   Important: Do not finish-weld the flanges to the pipe with the valve bolted between the flanges as this will result in serious heat-damage to the seat.

5. Finish-weld the flanges to the pipe and allow the flanges to cool completely.
6. Install the valve now according to the procedure for installing in existing systems.

Hamworthy Moss AS

Part no: N8661-001

FG: Item: 1

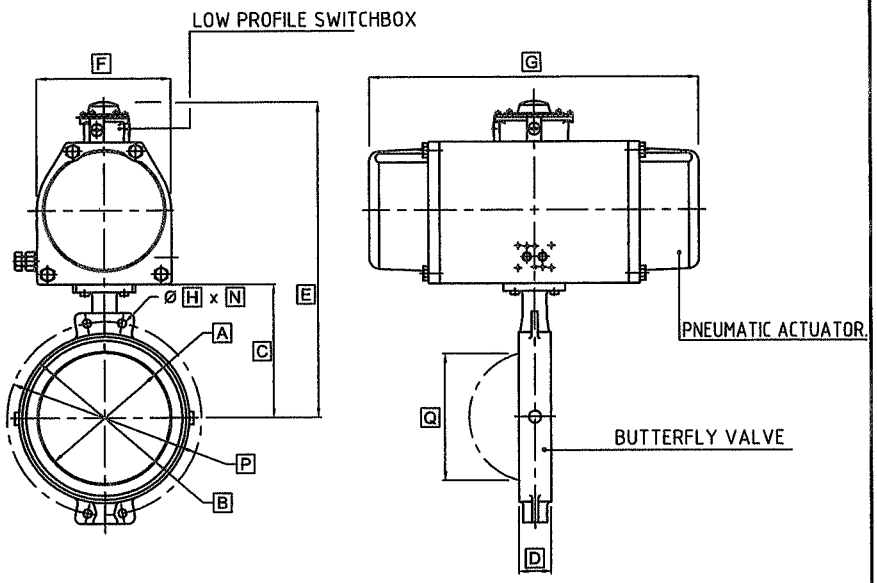
Rev: 00

Date: 20070925

SHUT OFF VALVE ASSEMBLY

DN400 DIN PN10

BUTTERFLY VALVE			ACTUATOR			SWITCHBOX			FLANGE		
FIG15-133			F79E-180S			FIG792 LP			DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
380	470	360	102	716	250	694	369	136kg	26	16	515



MATERIAL SPEC. MAIN PARTS FIG.14-137			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 20 CrNi 17 2	1.4057
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
						20070924	~	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replacec	Erstattet av Replaced by
	Title	E4063-11	
Hamworthy Moss AS	SHUT OFF VALVE ASSEMBLY FLANGE DN400 DIN PN10	N8661-001	Rev. 00
		Side Sheet 1 av sider 1 of 1 sheets	Format A4

Forandringen: REV 00) 20070924/

11-12

Hamworthy Moss AS

Part no: N8441-004

FG: Item: 2

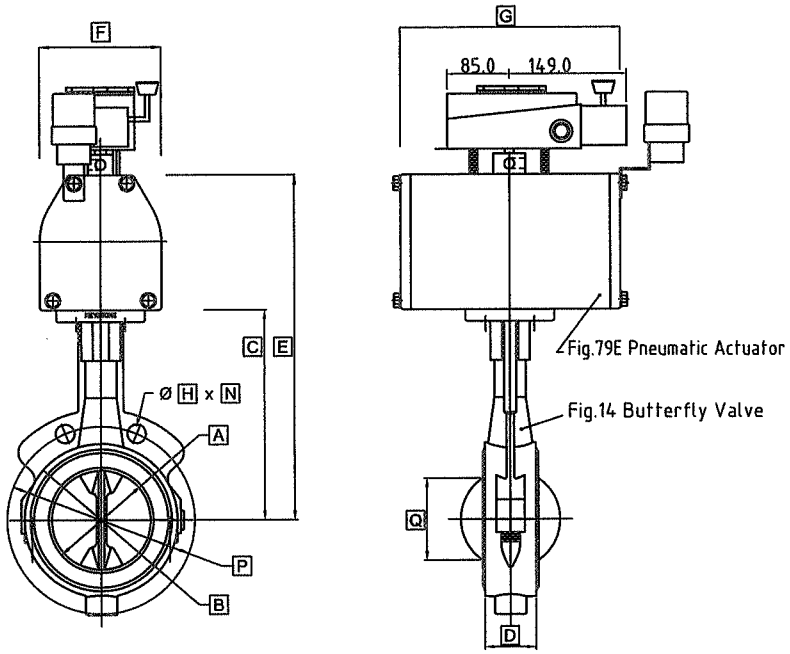
Rev: 00

Date: 20080204

CONTROL VALVE ASSEMBLY

DN300 DIN PN10

BUTTERFLY VALVE			ACTUATOR			POSITIONER			FLANGE		
FIG14-133			F79E-065			F793-011M (15-3psi)			DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
292	375	310	78	616	536	325	283	53.1kg	22	12	400



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 20 CrNi 17 2	1.4057
SEAT	NBR		

Forandringer: REV 00) 20071213/

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracat Traced	Kontr. Checkad	Godkj. App'd.	Dato Date 20071213	Skala Scale ~	Gruppe nr. Group. No.
Proj.metode Proj.method	MOSS INERT GAS SYSTEM						Erstn. for Replacec E4062-6	Erstattet av Replaced by
Hamworthy Moss AS	Title CONTROL VALVE W/MANUAL OVERRIDE ASSEMBLY FLANGE DN300 DIN PN10						N8441-004	Rev. 00
							Side Sheet 1 av of 1 sider sheets	Format A4

Hamworthy Moss AS

Part no: N8447-001 FG: Item: 4

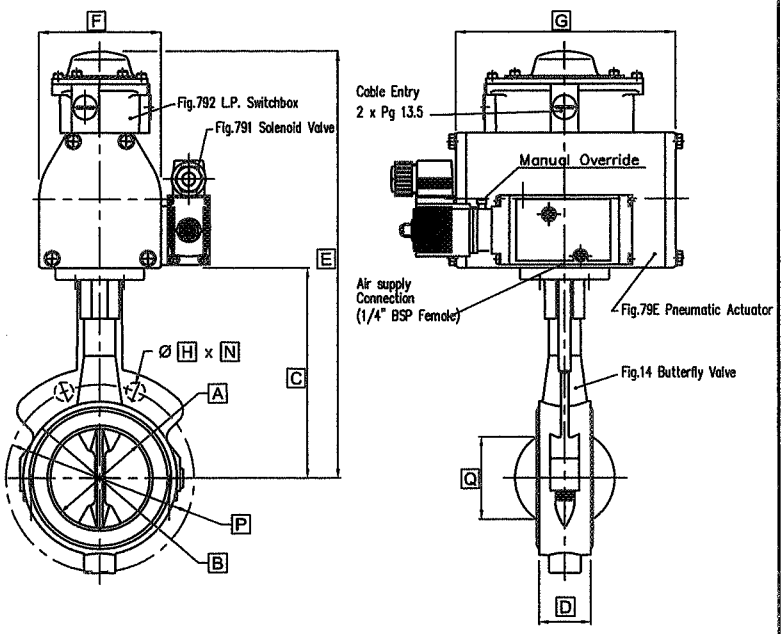
Rev: 00

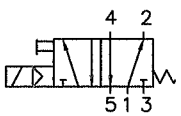
Date: 20070919

SHUT OFF VALVE ASSEMBLY

DN65 DIN PN10

BUTTERFLY VALVE			SOLENOID VALVE		ACTUATOR		SWITCHBOX		FLANGE		
FIG14-133			F791B		F79E-006		F792 LP		DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
62	109	150	46	342	93	167	43	8.5kg	18	4	145





SOLENOID SCHEMATIC. ~ 5/2 WAY

MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
						20070918	~	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replaced	Erstattet av Replaced by
	Title	E4062-4	
Hamworthy Moss AS	SHUT OFF VALVE ASSEMBLY FLANGE DN65 DIN PN10	N8447-001	Rev. 00
		Side Sheet 1 av of 1 sider sheets	Format A4

Forandringer: REV 001 20070918/

Hamworthy Moss AS

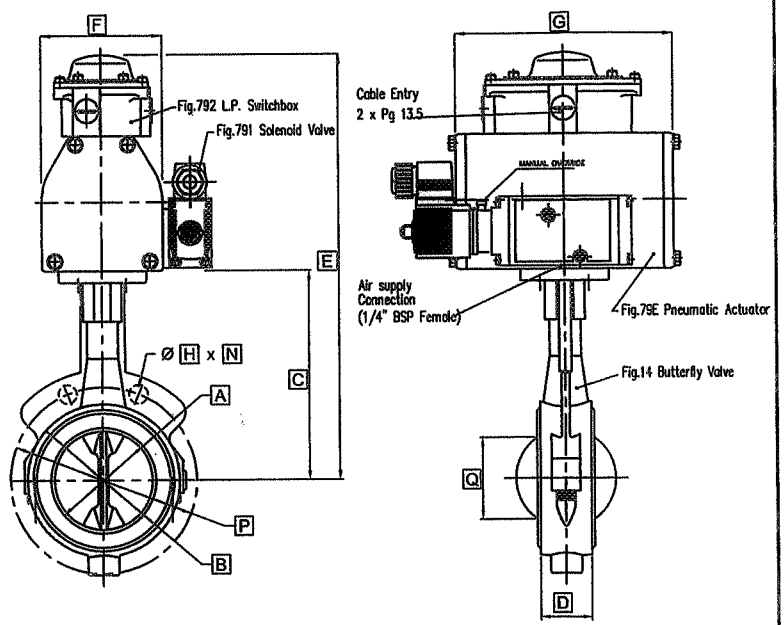
Part no: N8667-001 FG: Item: 5

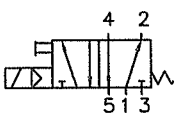
Rev: 00 Date: 20060509

SHUT OFF VALVE ASSEMBLY

DN150 DIN PN10

BUTTERFLY VALVE			SOLENOID VALVE		ACTUATOR		SWITCHBOX		FLANGE		
FIG14-133			F791B		F79E-012		F792 LP		DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
151	214	210	56	426	112	181	141	16.0kg	22	8	240





SOLENOID SCHEMATIC. ~ 5/2 WAY

MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scala	Gruppe nr. Group. No.
						20060301	~	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replacec	Erstattet av Replaced by
	Title	E4062-4	
Hamworthy Moss AS	SHUT OFF VALVE ASSEMBLY FLANGE DN150 DIN PN10	N8667-001	Rev. 00
		Side av sider Sheet 1 of 1 sheets	Format A4

Forandringer: REV 00) 20060301/

Hamworthy Moss AS

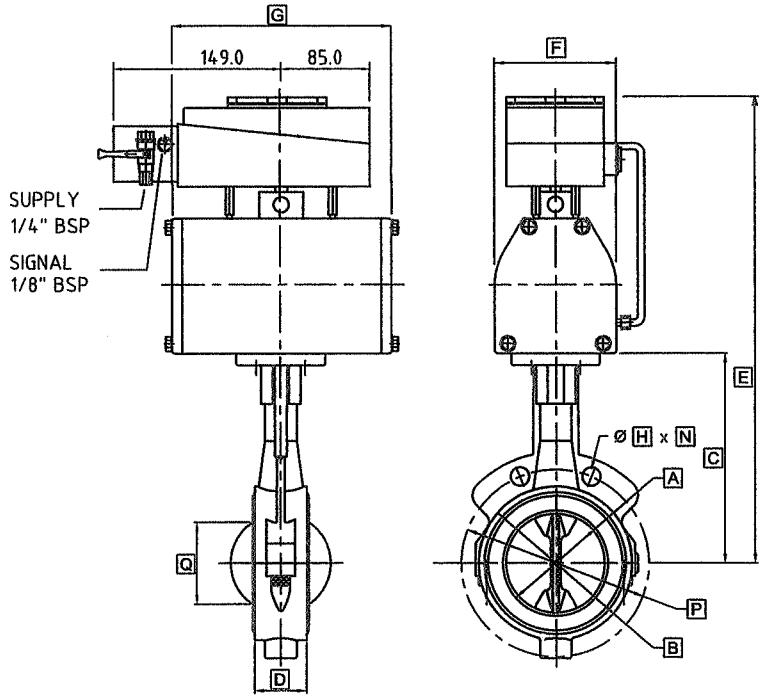
Part no: N8235-003 FG: Item: 7, 8

Rev: 00 Date: 20070907

CONTROL VALVE ASSEMBLY

DN250 DIN PN10

BUTTERFLY VALVE			ACTUATOR			POSITIONER			FLANGE		
FIG14-133			F79E-036			F793-011M (3-15psi)			DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
245	321	275	68	577	152	273	237	38.4kg	22	12	350



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
						20070907	~	

Proj.metode / Proj.method

Hamworthy KSE a.s, Moss
Liquid Cargo Handling

MOSS INERT GAS SYSTEM

Title: CONTROL VALVE W/MANUAL OVERRIDE ASSEMBLY FLANGE DN250 DIN PN10

Erstn. for Replacec: E4042c

Erstattet av Replaced by:

N8235-003 Rev. 00

Side Sheet 1 av of 1 sider sheets Format A4

Forandringer: REV 00) 20070907/

11-16

Hamworthy Moss AS

Part no: M6560-004 FG: Item: 10

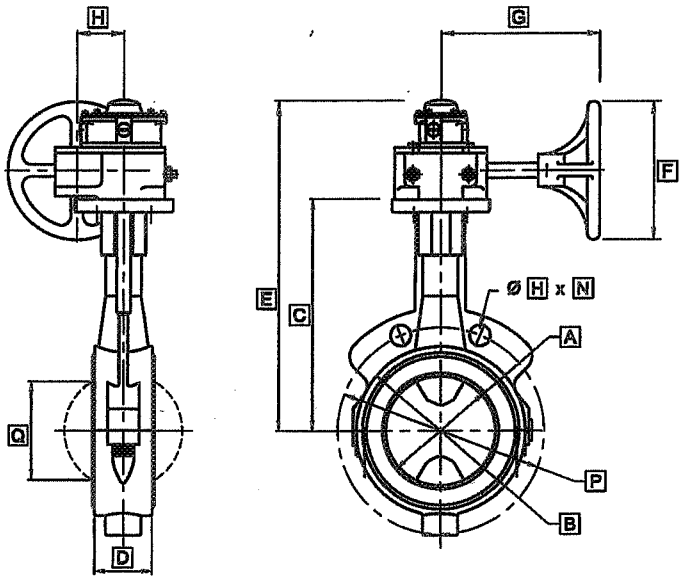
Rev: 00

Date: 20080313

SHUT OFF VALVE ASSEMBLY

DN300 DIN PN10

BUTTERFLY VALVE			GEARBOX TYPE/SIZE			SWITCHBOX			FLANGE		
FIG14-133			F455-WMK009			FIG792 LP			DIN PN10		
A	B	C	D	E	F	G	H	Q	MASS	øH	N	P
292	375	310	78	437	300	294	63	283	43,0kg	22	12	400



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Byggnr. / Yard No | Ordrenr. / Order No. | Tegn. / Drawn | Tracet / Traced | Kontr. / Checked | Godkj. / App'd. | Dato / Date: 20080313 | Skala / Scale: ~ | Gruppe nr. / Group No.

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for / Replaces: E4050-10 | Erstattet av / Replaced by

Hamworthy Moss AS

Title: SHUT OFF VALVE ASSEMBLY FLANGE DN300 DIN PN10

M6560-004 | Rev. 00

Side / Sheet 1 av / of 1 sider / sheets | Format A4

Forandringer: REV 00) 20080313/

Hamworthy Moss AS

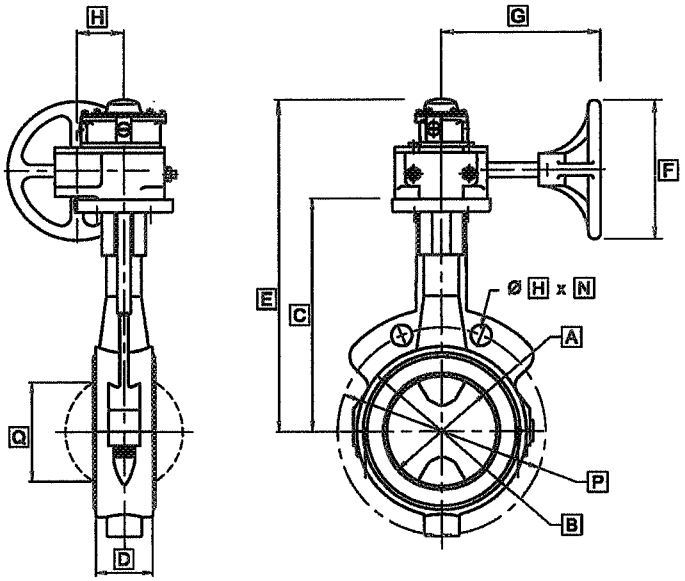
Part no: M6560-004 FG: Item: 11

Rev: 00 Date: 20080313

SHUT OFF VALVE ASSEMBLY

DN300 DIN PN10

BUTTERFLY VALVE			GEARBOX TYPE/SIZE			SWITCHBOX		FLANGE			
FIG14-133			F455-WMK009			FIG792 LP		DIN PN10			
A	B	C	D	E	F	G	H	Q	MASS	øH	N	P
292	375	310	78	437	300	294	63	283	43,0kg	22	12	400



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Date Date 20080313	Skala Scale ~	Gruppe nr. Group. No.

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replaces E4050-10	Erstattet av Replaced by
Hamworthy Moss AS	Title: SHUT OFF VALVE ASSEMBLY FLANGE DN300 DIN PN10	M6560-004	Rev. 00
		Side Sheet 1 av of 1 sider sheets	Format A4

Forandringer: REV 00) 20080313/

Hamworthy Moss AS

Part no: N8440-001

FG: Item: 47

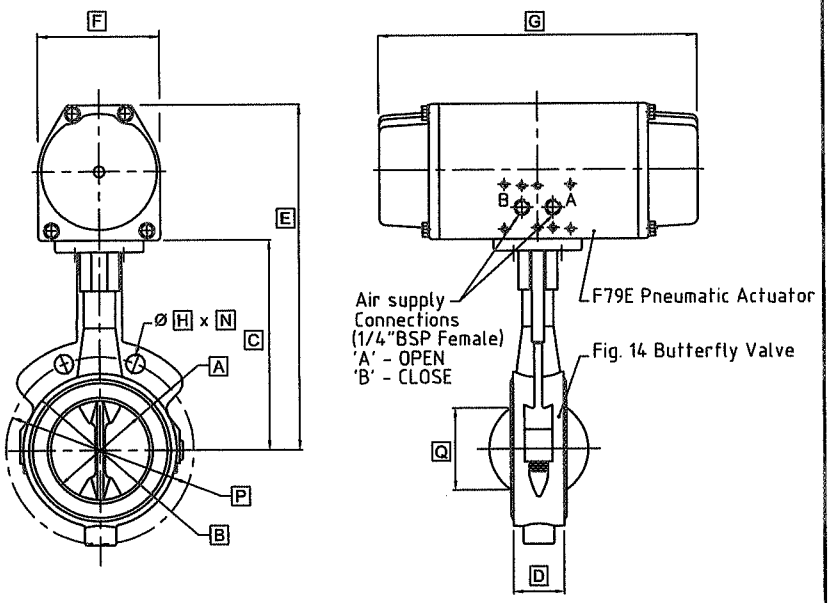
Rev: 00

Date: 20060509

SHUT OFF VALVE ASSEMBLY

DN50 DIN PN10

BUTTERFLY VALVE				ACTUATOR					FLANGE		
FIG14-133 (SPRING OPEN)				F79E-006S					DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
50	94	135	43	247	93	257	27	6,1 kg	18	4	125



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Tracad	Kontr. Checked	Godkj. App'd.	Dato Data	Skala Scale	Gruppe nr. Group. No.
						20060301	~	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replacac	Erstattet av Replaced by
	Title	E4122-3	
Hamworthy Moss AS	SHUT OFF VALVE ASSEMBLY FLANGE DN50 DIN PN10	N8440-001	Rev. 00
		Side Sheet 1 av of 1 sider sheets	Format A4

Forandringer: REV 00: 20060301/

Hamworthy Moss AS

Part no: N2863-001

FG: Item: 48

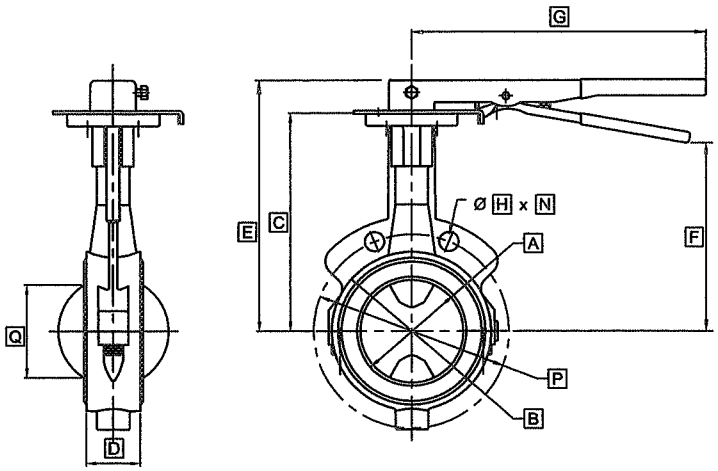
Rev: 01

Date: 20070925

BUTTERFLY VALVE

DN50 DIN PN10

BUTTERFLY VALVE					HANDLEVER TYPE				FLANGE		
FIG14-133					F412-015				DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
50	94	135	43	160	125	180	27	2,7 kg	18	4	125



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
						20070920	~	

Proj.metode Proj.method	MOSS INERT GAS SYSTEM	Erstn. for Replacec	Erstattet av Replaced by
	Title	E4048-2	
Hamworthy Moss AS	BUTTEFLY VALVE WITH HANDLEVER FLANGE DN50 DIN PN10	N2863-001	Rev. 00
		Side Sheet 1 of 1 av sider sheets	Format A4

Forandringer: REV 00) 20070920/ REV 01) 20070925/ ADDED HANDLEVER

11-20

Hamworthy Moss AS

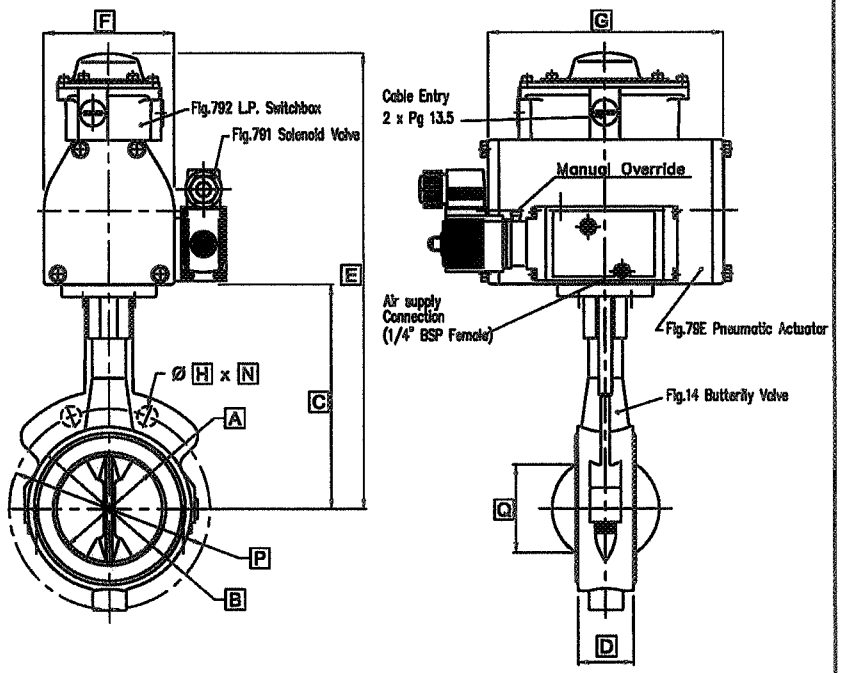
Part no: N8777-001 TG: Item: 5

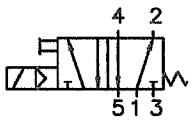
Rev: 00 Date: 20080307

SHUT OFF VALVE ASSEMBLY

DN80 DIN PN10

BUTTERFLY VALVE			SOLENOID VALVE		ACTUATOR		SWITCHBOX		FLANGE		
FIG14-133			F791B		F79E-006		F792 LP		DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
78	126	160	46	352	93	167	64	8.9kg	18	8	160





SOLENOID SCHEMATIC. ~ 5/2 WAY

MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Tegningsnr. / Yard No | Ordre nr. / Order No. | Tegn. / Drawn | Tracet / Traced | Kontr. / Checked | Godkj. / App'd. | Dato / Date: 20071213 | Skala / Scale: ~ | Gruppe nr. / Group. No.

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for / Replaces: E4062-4 | Erstattet av / Replaced by

Hamworthy Moss AS

Title: SHUT OFF VALVE ASSEMBLY FLANGE DN80 DIN PN10

N8777-001 | Rev. 00

Side / Sheet 1 av / of 1 sider / sheets | Format A4

Forandringer: REV 00) 20071213/

11-21

Hamworthy Moss AS

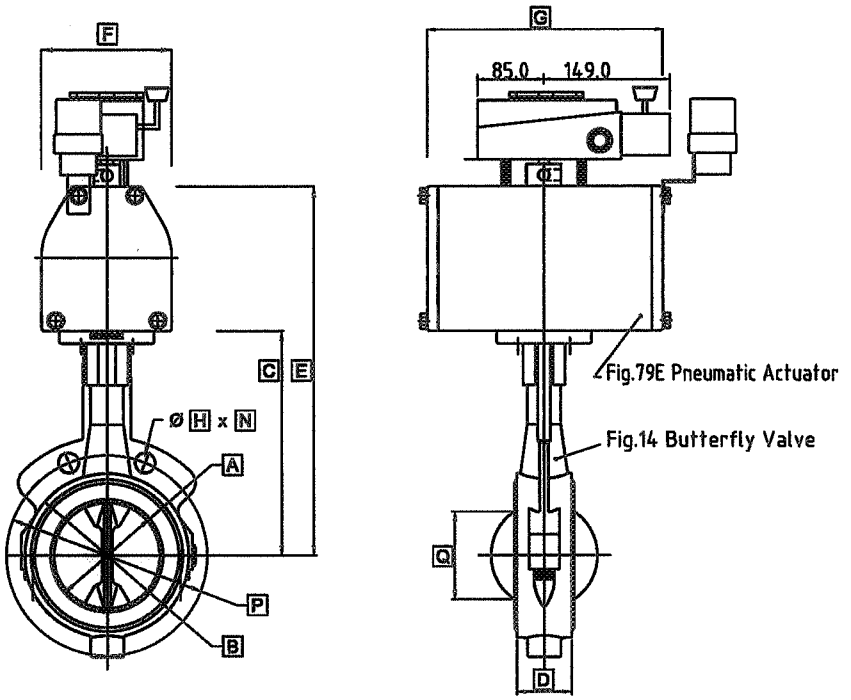
Part no: N8162-006 TG: Item: 6

Rev: 00 Date: 20080307

CONTROL VALVE ASSEMBLY

DN80 DIN PN10

BUTTERFLY VALVE			ACTUATOR			POSITIONER			FLANGE		
FIG14-133			F79E-006			F793-011M (15-3psi)			DIN PN10		
A	B	C	D	E	F	G	Q	MASS	øH	N	P
78	126	160	46	298	93	167	64	8.9kg	18	8	160



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 20 CrNi 17 2	1.4057
SEAT	NBR		

Dwg nr. / Yard No	Ordre nr. / Order No.	Tegn. / Drawn	Tracet / Traced	Kontr. / Checked	Godkj. / App'd.	Date / Date	Skala / Scale	Gruppe nr. / Group. No.
						20071213	~	

Proj.metode / Proj.method	MOSS INERT GAS SYSTEM	Erstn. for / Replacec	Erstattet av / Replaced by
Hamworthy Moss AS	Title: CONTROL VALVE W/MANUAL OVERRIDE ASSEMBLY FLANGE DN80 DIN PN10	E4062-6	
		N8162-006	Rev. 00
		Side / Sheet: 1 av / of 1 sider / sheets	Format: A4

Forandringen: REV 00) 20071213/

11-22

Hamworthy Moss AS

Part no: M1301-001 TG: Item: 50

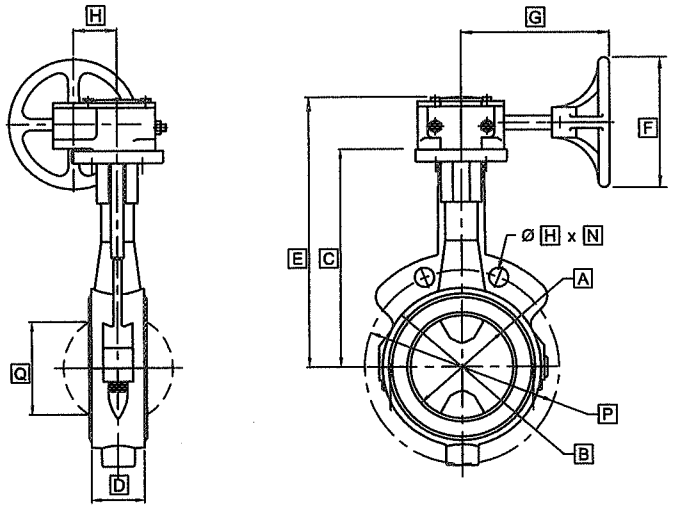
Rev: 00

Date: 20070904

CONTROL VALVE ASSEMBLY

DN50 DIN PN10

BUTTERFLY VALVE					GEARBOX TYPE/SIZE					FLANGE		
FIG14-133					QE4					DIN PN10		
A	B	C	D	E	F	G	H	Q	MASS	øH	N	P
50	94	135	43	202	150	176	50	27	6.1kg	18	4	125



MATERIAL SPEC. MAIN PARTS FIG.14-133			
PART	MATERIAL	DIN DESIGNATION	DIN MATRIAL No.
BODY	CAST IRON	GG-25	0.6025
DISC	NiAlBz	G-CuAl10Ni	2.0975.01
SHAFT	STAINLESS STEEL	X 5 CrNiMo 17 12 2	1.4401
SEAT	NBR		

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
						20070830	~	

Proj.metode / Proj.method

Hamworthy KSE a.s, Moss
Liquid Cargo Handling

MOSS INERT GAS SYSTEM

Title: CONTROL VALVE ASSEMBLY FLANGE DN50 DIN PN10

Erstn. for Replacec: E4050-3

Erstattet av / Replaced by:

M1301-001 Rev. 00

Side / Sheet: 1 av / of 1 sider / sheets

Format: A4

Forandringer: REV 00) 20070830/

11-23

Hamworthy Moss AS

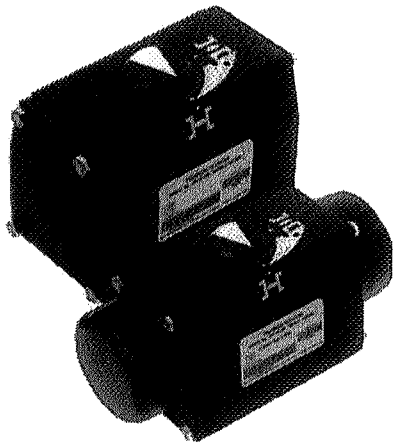
Part no: M9721-001txt Item:

Rev: 01 Date: 20050105

PNEUMATIC ACTUATOR

Fig. 79U/E/D - models 002-180

User manual



Double Acting (air to air) and Single Acting (spring return), 90° operation, pneumatic actuators.

General applications

For remote control of any quarter turn application, for example Ball, Butterfly or Rotary Plug Valves, Dampers etc.

Features

- Compact rack and pinion design utilising the whole piston area to develop output torque.
- Pistons with integral rack drive reducing the number of dynamic seals, minimising air leakage.
- Double pistons nullify sideloads on the pinion shaft, minimising bearing wear.
- Springs epoxy colour coded for additional corrosion protection and ease of identification
- Hard anodised aluminium body, with external ESPC finish, protects against corrosive environments including saliferous atmospheres.
- Alternative finish: electroless nickel plating of body, pistons and end caps.
- Female output drive enabling direct mounting in certain applications, thereby eliminating special connections and guaranteeing correct alignment.
- Bottom entry pinion shaft.
- Anti-friction piston pads ensuring no metal to metal contact, providing a smooth operation. Ideal for modulating or on/off control applications.

Adjustable travel stops in both directions on certain models (see pages 2 and 3) Grease lubricated for life.

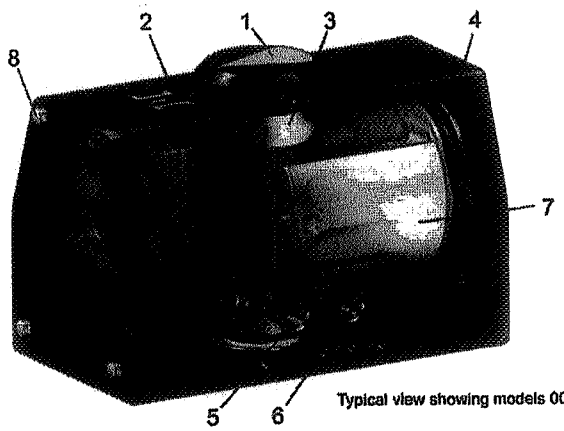
Technical Data	
Max. supply pressure	10 bar g
Rated supply pressure	8.3 bar g
Output torque @ 5.5 bar	
Double Acting models	up to 2054 Nm
Spring return models	up to 1414 Nm
Temperature range	30° to +90°C* with standard components.
* For higher temperature applications other materials available on request.	

Accessories

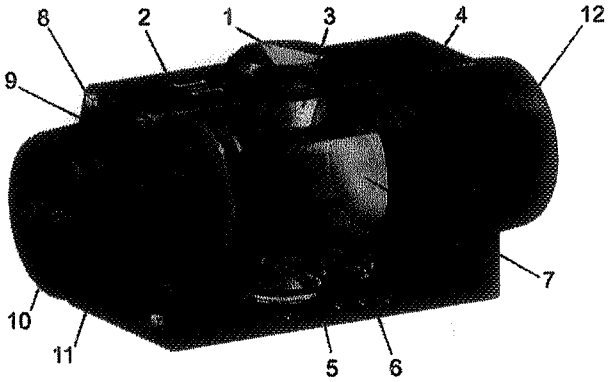
An extensive range of standard accessories is available for direct mounting to Keystone actuators.

- Solenoid Valves - weatherproof, explosion-proof or intrinsically safe.
- Limit Switchboxes - weatherproof, explosion-proof or intelligent.
- Positioners - pneumatic, electro-pneumatic or intelligent.
- Declutchable manual override gearbox.
- High Visibility Indicator.
- Proximity sensing - weatherproof intrinsically safe, or intelligent.

Figure 79 U/E range



Typical view showing models 002-036



Typical view showing models 002-036 (Representation only, spring colours may differ)

Double Acting and Spring Return Pneumatic Actuators incorporating mounting flange configurations to Keystone or ISO 5211 Standards.

79U - Keystone Standard
79E - ISO 5211 Standard

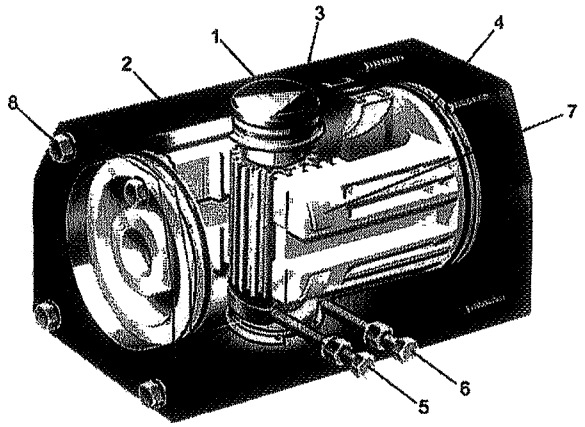
Travel Stops: Open and closed adjustable travel stops are fitted on models 065, 066, 090, 091, 180, 181

1. Position indicator/dust cover
2. Precision extruded body, hard anodised for maximum environmental protection.
3. Engineered polymer bearings give maximum efficiency and eliminate galvanic corrosion.
4. Piston seals.
5. Air supply to close (port B).
6. Air supply to open (port A)
7. Anti-friction piston pads.
8. Stainless steel fasteners.
9. Retaining cone.*
10. Retaining bolt.
11. Springs.*
12. End cap.

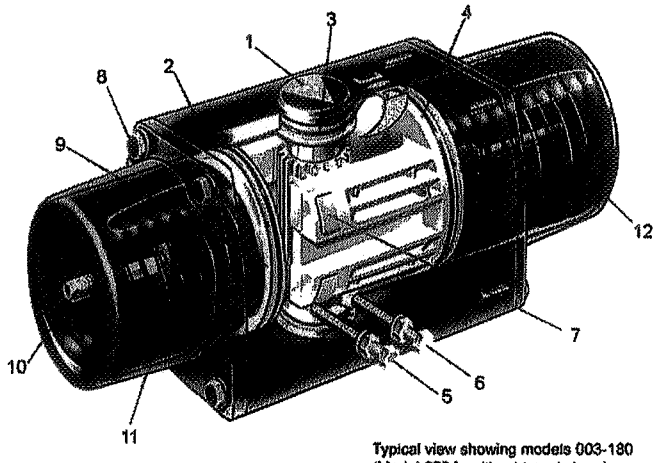
*Spring Return models only

MATERIALS OF CONSTRUCTION			
Part	**Material**	**British Standard**	**Equivalent Standard**
Body	Extruded aluminium hard anodised & ESPC* (or ENP†)	BS1474 6063	DIN 3.3206.51
Endcaps	Die cast aluminium LM6 or LM24 anodised & ESPC* (or ENP†)	BS1490	DIN 1725 - 230 or 226
Piston (002/003) (Other models)	Glass filled nylon 66 Die cast aluminium LM6 or LM24 anodised	BS1490	DIN 1725 - 230 or 226
Pinion (002 only) (Other models)	Glass filled nylon 66 Carbon steel (sealbond - N coated)	BS970 080M40	C40
Spring	Spring steel	BS5216 HS3	DIN 17223 Pti
Cone	Die cast aluminium LM6	BS1490	DIN 1725
Bearings	Devlon - V or equivalent		
Travel Stops	Stainless steel A2/70	BS970 Part 3 - 304/305	DIN 267 Part 3
Bellhof Nut	Carbon Steel (Zinc Plated)		
O-Rings	Nitrile		
Fasteners	Stainless steel A2/70	BS970 Part 3 - 304/305	DIN 267 Part 3
† Electroless Nickel Plating (when this finish is specified)		* Electro Static Powder Coating	

Figure 79 D range



Typical view showing models 003-180
(Model 002 is without travel stops)



Typical view showing models 003-180
(Model 002 is without travel stops)

Double Acting and Spring Return Pneumatic Actuators incorporating mounting flange configurations to DIN and NAMUR standards.

79D - DIN and NAMUR Standards

Travel Stops: Open and closed adjustable travel stops are fitted, for precise travel limitation. (Except size 002)

1. Position indicator/dust cover
2. Precision extruded body, hard anodised for maximum environmental protection.
3. Engineered polymer bearings give maximum efficiency and eliminate galvanic corrosion
4. Piston seals.
5. Travel stop bolt - open.
6. Travel stop bolt - close.
7. Anti-friction piston pads.
8. Stainless steel fasteners.
9. Retaining cone.*
10. Retaining bolt.
11. Spring.*
12. End cap.

*Spring Return models only

MATERIALS OF CONSTRUCTION			
Part	**Material**	**British Standard**	**Equivalent Standard**
Body	Extruded aluminium hard anodised & ESPC* (or ENP†)	BS1474 6063	DIN 3.3206.51
Endcaps	Die cast aluminium LM6 or LM24 anodised & ESPC* (or ENP†)	BS1490	DIN 1725 - 230 or 226
Piston (002/003) (Other models)	Glass filled nylon 66 Die cast aluminium LM6 or LM24 anodised	BS1490	DIN 1725 - 230 or 226
Pinion (002 only) (Other models)	Glass filled nylon 66 Carbon steel (sealbond - N coated)	BS970 080M40	C40
Spring	Spring steel	BS5216 HS3	DIN 17223 Pti
Cone	Die cast aluminium LM6	BS1490	DIN 1725
Bearings	Devlon - V or equivalent		
Travel Stops	Stainless steel A2/70	BS970 Part 3 - 304/305	DIN 267 Part 3
Bellhof Nut	Carbon Steel (Zinc Plated)		
O-Rings	Nitrile		
Fasteners	Stainless steel A2/70	BS970 Part 3 - 304/305	DIN 267 Part 3
† Electroless Nickel Plating (when this finish is specified)		* Electro Static Powder Coating	

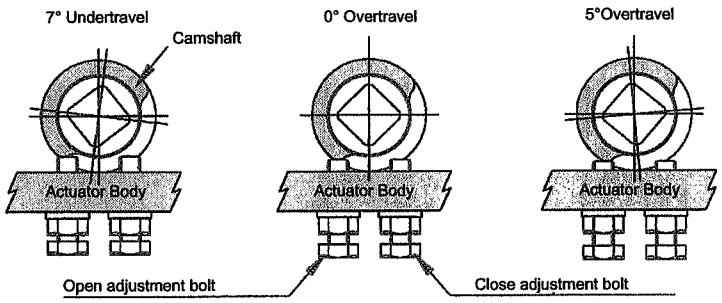
Part no: M9721-001txt Item:

MOUNTING FLANGE DIMENSION DETAILS		
Mounting Compatibility Codes	**PCD**	**Bolt Holes**
XAD	44.45	4 x M6 x 10 Dp.
BAD	82.6	4 x M10 x 13 Dp.
CAE	127.0	4 x M12 x 16 Dp.
CAF	127.0	4 x M12 x 16 Dp.
CAG	127.0	4 x M12 x 19 Dp.
CAH	127.0	4 x M12 x 19 Dp.
XAA	127.0	4 x M12 x 16 Dp.
XAB	127.0	4 x M12 x 19 Dp.
DAJ	165.0	4 x M20 x 25 Dp.
DAK	165.0	4 x M20 x 25 Dp.
XAG	165	4 x M20 x 25 Dp.

NOTES

1. The compatability codes also refer to the bore and key of the pinion drive in order to accomodate the valve shaft and top-works details

Bi-directional travel stops



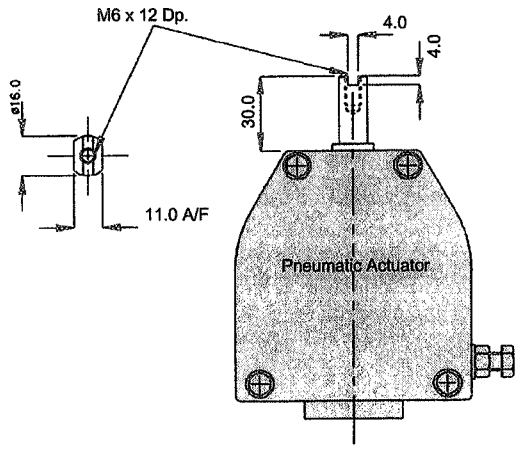
All views illustrated in the open position

NOTES

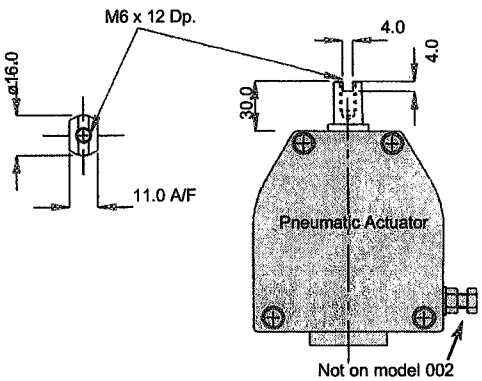
1. Adjustable travel stops are fitted as standard to the following models:
   79U/E - models 065, 090 and 180
   79D - models 003, 006, 012, 024, 036,065, 066, 090, 091, 180 and 181
2. Adjustable stops on the centre of the body provide the flexibility of accurate valve rotational positioning at the end of the 'open' and 'close' stroke.
3. The total travel of 100 degrees allows for end of travel adjustment of 5 degrees over / 7 degrees under at both open and close positions.
4. Travel stops must not be used for manual override purposes.
5. When Namur adaptor is not supplied, the actuator is designated Fig 79L.

Namur accessory adaptor details (Fig. 79D)

See note 5



Models 065/180



Models 002/036

ACTUATOR OPERATING TIMES (seconds)

Double Acting models

	Moving Time		Total Time	
Actuator	Opening	Closing	Opening	Closing
002	0.050	0.050	0.060	0.060
003	0.050	0.050	0.060	0.060
006	0.075	0.080	0.080	0.090
012	0.120	0.130	0.160	0.200
024	0.220	0.250	0.420	0.450
036	0.300	0.350	0.550	0.600
065/066	0.550	0.600	1.100	1.200
090/091	0.700	0.900	1.500	1.700
180/181	1.600	1.700	2.800	2.850

Spring Return models

	Moving Time		Total Time	
Actuator	Opening	Closing	Opening	Closing
002S	0.070	0.070	0.080	0.080
003S	0.070	0.070	0.080	0.080
006S	0.070	0.070	0.130	0.080
012S	0.140	0.120	0.220	0.200
024S	0.750	0.250	1.000	0.350
036S	0.750	0.300	1.050	0.500
065S/066S	1.600	0.600	2.300	0.800
090S/091S	1.900	0.700	2.600	1.200
180S/181S	1.500	1.400	3.600	2.300

ACTUATOR PISTON DISPLACEMENT(in litres)

Actuator	Open (Double Acting and Spring Return)	Close (Double Acting only)
002	0.137	0.097
003	0.187	0.123
006	0.346	0.234
012	0.629	0.455
024	1.290	0.912
036	1.945	1.363
065/066	3.523	2.635
090/091	4.779	3.347
180/181	9.690	6.700

STANDARD SPRING COLOUR CODES

40 psi	-2.8 bar	Light Blue (both ends)	
50 psi	- 3.5 bar	Light Blue (one ends)	White (other end)
60 psi	- 4.2 bar	White (Both ends)	
70 psi	- 4.8 bar	Light Blue/Dark Blue*	White (other end)
80 psi	- 5.5 bar	Light Blue/Dark Blue* (both ends)	
90 psi	- 6.2 bar	Light Blue/White*	Light Blue/Dark Blue* (other ends)
100 psi	- 6.9 bar	Light Blue/White* (Both ends)	

* Nested (double) spring

NOTES

1. Operating times under no load, for air pressures of 5.5 barg (80psi). (Times based on actual measurements)
2. All times obtained using a standard direct mounted 791B, 5/2(DA) and 3/2(SA) solenoid valve with a CV of 0.97 and no exhaust restrictors, with 8.0mm diameter air connections and piping.
3. Total time is defined as time required from energising/de-energising Solenoid Valve to completion of 90° stroke.
4. Times for Single Acting Actuators are for Fail Close.
5. Piston displacement is the total volume of pressurised air after the actuator has completed its stroke.

For optimum performance on Ball Valves utilise 70/90 psi springs when a 80/100 psi air supply is specified.

Hamworthy Moss AS

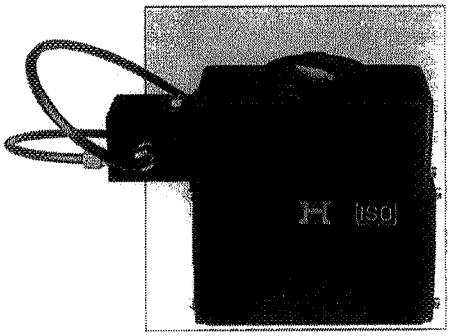
Part no: M1014-000txt Item:

Rev: 00 Date: 20070614

PNEUMATIC POSITIONER

Fig. 793

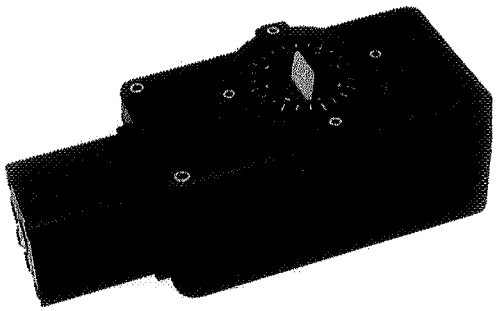
User manual



A pneumatic positioner with the unique option of either proximity or electric integral limitswitches. The positioner, in line with other of the suppliers accessories, is suitable for direct mounting to the range of pneumatic actuators.

Features

- Compact design - mounted directly and axially to the actuator stem, by means of standard kit.
- Clockwise or counter-clockwise models.
- No external springs, all vulnarable parts completely enclosed.
- Highly visual local inidication of actuator position.
- Stable positioning characteristics are provided for both small and large actuators.
- Good vibration resistant cahracteristics.
- Action (direct of reverse) is easily reversed in the field by turning cam and reversing air connection.
- Feedback, linear, via 3 lobe cam.
- Customised cam profiling is possible to give special characterisation.
- Span and zero adjustment.
- Usable for double-acting or single-acting service.
- Unaffected by normal supply pressure fluctuations.

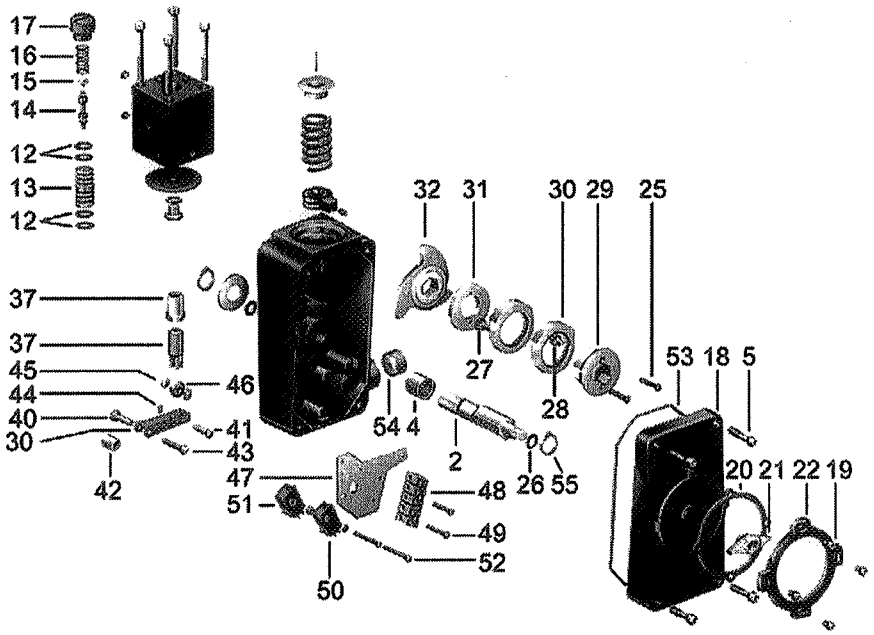


General application

The suppliers positioner is designed for the proportional operation of 1/4 turn rotary actuators, it is generally coupled axially to the shaft of the actuator, the indicator gives visual position of the final control elemant. The action is based on a force balance principle.

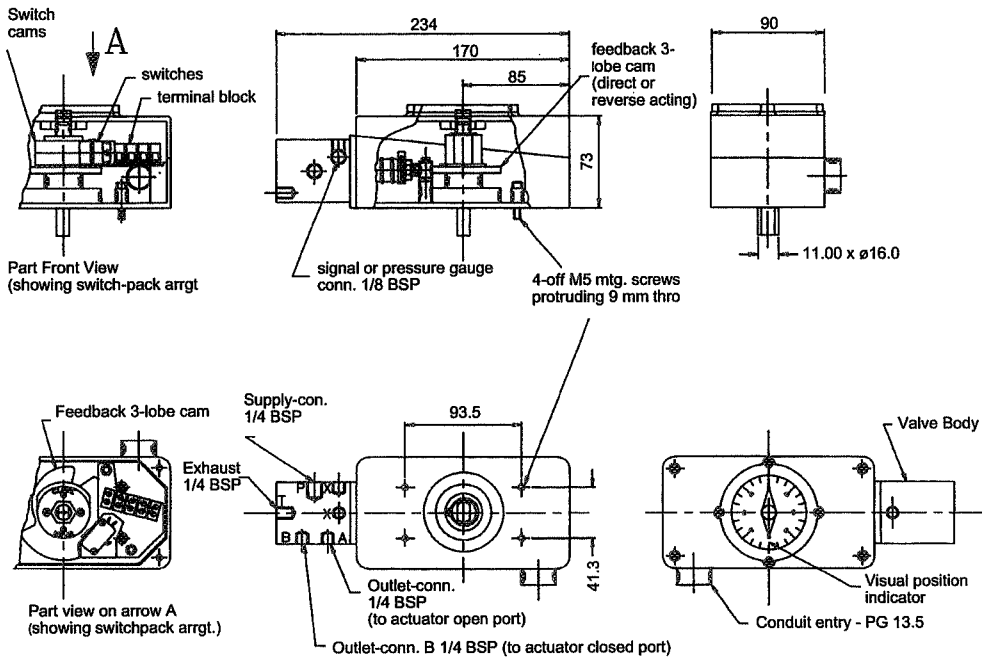
Hamworthy Moss AS

Part no: M1014-000txt Item:



Item	Description	Qty	Material	Item	Description	Qty	Matesrial
1	Circlip	1	Spring steel	30	Cam	2	Nylon-minlon
2	Shaft	1	Stainless steel 303S21	31	Locking plate	1	Stainless steel 303S21
3	Washer	1	Stainless steel 303S21	32	Feedback cam	1	Glass reinforced acetal resin
4	Bearing needle roller	1	-				
5	Captive screw	8	Stainless steel A2	33	Body	1	Pressure die cast Aluninium LM24
6	Bolt diaphragm clamp	1	Stainless steel 303S21				
7	Washer	1	Acetal-black	34	Feedback spring	1	Stainless steel A2
8	Diaphragm	1	Neoprene	35	Screw grub	1	Stainless steel A2
9	Base cap-feedback spring	1	Stainless steel 303S21	36	Feedback spring rate adjuster	1	Acetal
10	Pin-spool pivot	1	Stainless steel 302/303				
11	Valve body	1	Aluminium HE30	37	Adjuster-zero feedback spring	1	Stainless steel 303S21
12	O-ring	4	Nitrile				
13	Cartridge	1	Aluminium bronze	38	Locator-small bearing	1	Stainless steel 303S21
14	Spool	1	Stainless steel 303S21	39	Arm-feedback	1	Stainless steel 304S15
15	Locator-spool bias spring	1	Brass CZ121	40	Bush-feedback arm	1	Stainless steel 303S21
16	Spring-spool bias	1	Stainless steel 302S25	41	Pin-small bearing	1	Stainless steel 303S21
17	Endcap	1	Aluminium 201FC1	42	Spacer-support feedback arm	1	Acetal
18	Cover	1	Pressure die cast Aluminium LM24	43	Socket head cap screw	1	Stainless steel A2
19	Socket head cap screw	4	Stainless steel A2	44	Circlip	1	Spring steel
20	Gasket	1	Nitrile	45	Washer-small bearing	2	Nylon
21	Position indicator	1	Acetal-yellow	46	Bearing needle roller	1	-
22	Position indicator cover	1	Polycarbonate-black Acrylic insert	47	Switch mounting plate	1	Steel
				48	Terminal block	1	Bakelite
23	Socket head cap screw	4	Stainless steel A2	49	Screw pan head	2	Steel
24	O-ring	1	Nitrile	50	Spacer	2	Nylon
25	Pan head screw	2	Spring steel	51	Microswitch-V9 og V3	2	-
26	O-ring	1	Steel	52	Screw pan head	2	Steel
27	Screw-adjustment-close	1	Stainless steel A2	53	O-ring	1	Nitrile
28	Screw-adjustment-open	1	Stainless steel A2	54	Plug	1	Steel
29	Cam sleeve	1	Nylon-inlon	55	Circlip	1	Spring steel

Part no: M1014-000txt Item:

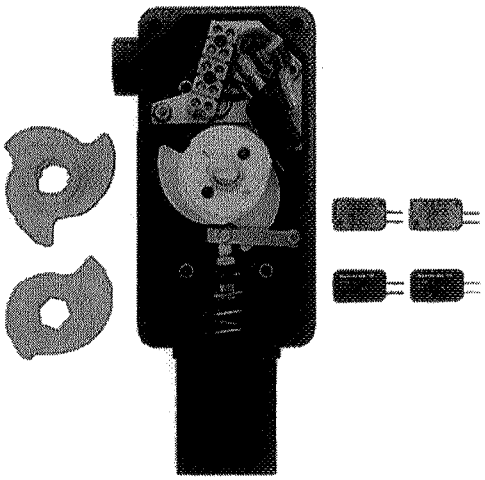


Designation of connections: A & B = Working Lines P - Compressed Air Connection T- Exhaust Point X - Control Line

General specifications

Input signal	**Signle range**	**- 3 -15 psi (0.2 - 1.0 bar) standardl**
	Split range	**- 3 - 9 psi (0.2 - 0.6 bar) 9 - 15 psi (0.6 - 1.0 bar).**
	Cam characteristics	**- Linear**
	3 - lobe cam	**- Curve 1, range: 3 - 15 psi = 90⁰ movement.**
		Curve 2, range: 3 - 9 psi or 9 - 15 psi = 65⁰ movement.
		Curve 3, range: 3 - 15 psi = 65⁰ movement.
		Other characteristics on request.
Supply	**Media**	**- Compressed air or gas, dry, dust and oil free with 5 filter element to**
	Supply pressure	**- inlet.**
	Air consumption	**- 30 - 100 psi (150 psi max.) 2 - 8 bar (10 bar max.).**
		0.6 cfm in balanced condition with 60 psi (4 bar) supply
Environmental mounting and connections	**Environmental tempera-ture**	**- -5⁰ to + 160⁰F (-20⁰ to +70⁰C).**
	Mounting position	**- As required. No limitations.**
	Mounting kit	**- Universal mounting kit for Fig.790/796 series actuators.**
	Air connections	**- Supply and output 1/4" BSP, signal 1/8" BSP**
Materials of construction	**Housing**	**- Anodised aluminium alloy (stainless steel optional).**
	Diaphragm	**- Nitrile rubber**
	Valve spool	**- Stainless steel**
	Cover	**- Anodised aluminium alloy (stainless steel optional).**
Weight		**- 1.85kg (4 lb.)**
Options	**Gauges**	**- Instrument air 0 - 30 psi (0 - 2 bar) - 1 off.**
		Supply air 0 - 150 psi (0 - 8 bar) - 2 off
	Integral limit switches	**- Single pole double throw 10A 240V AC**
		Inductive proximity sensors type NT2-V3-N

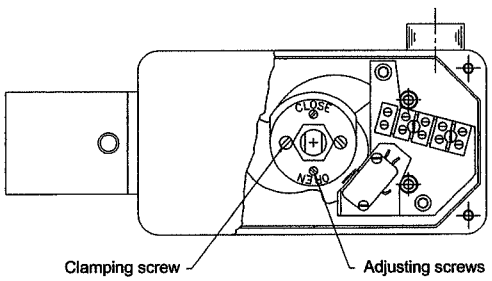
Part no: M1014-000txt Item:



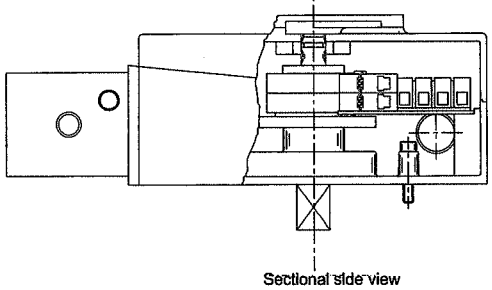
Static performance

Hysteresis	:	< 1,5%
Repeatability	:	< 0,5%
Linearity	:	< 1,0%
Supply Pressure Effect	:	Minimal
Sensitivity	:	< 1,0%
Power Amplification	:	2.5% deviation gives full differential
Air Consumption	:	0.6 cfm 916.99 lm) at balance with 60 PSIG (4 bar) supply
	:	1.2 seconds per 100 cubic in. (1.64 Litres) of Actuator Displacement
Weight	:	4 lb (1,85 kg)
Supply Pressure	:	30-120 psig (150 psig max.) 2-8.25 bar g (10 bar g max.)
Signal Ranges	:	3-15 psi (0,2 to 1,0 bar) over 90° movement - CAM 1 3-15 psi (0,2 to 1,0 bar) over 65° movement - CAM 2 3-9 psi (0,2 to 0,6 bar) OR 9-15 psi (0,6 to 1,0 bar) over 65° movement - CAM 3 CAM Characteristics - Linear (other available on request)
Temperature Range	:	-20°C to +70°C

IP65 rated when switches enclosed



Sectional plan view



Sectional side view

Retrofit procedure

1. Remove positioner cover.
2. Remove circlip from top of camshaft.
3. Remove spacer from camshaft.
4. Fit cam assembly onto hexagon camshaft with adjusting and clamping screws towards the outboard end. **Note:** The assembly has been made with a tight fil onto the exagon shaft in order to eliminate any backlash. It may be necessary to drive the assembly over the shaft. To do this, use the original spacer as a drift and rive the assembly over the shaft using a light hammer.
5. Fit the microswitch/terminal plate as shown, using the two M5 hexagon socket cap screws.
6. Set the cams in accordance with the procedure.
7. Re-fit the cover.

Cam setting procedure

1. Release both clamping screws by turning each screw approximately 1,5 turns anti-clockwise.
2. Operate positioner/actuator to close position.
3. Adjust "CLOSE" adjusting screw by turning clockwise untill lower cam just triggers the lower switch.
4. Operate positioner to open position.
5. Adjust "OPEN" adjusting screw by turning anti-clockwise until upper cam just triggers the upper switch.
6. Tighten both clamping screws to lock the cams in the set position.
7. Operate the positioner/actuator open and closed to check the cam operation and re-adjust if necessary.

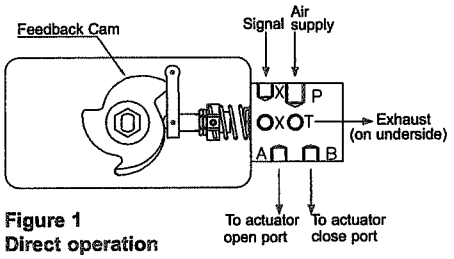


Figure 1
Direct operation

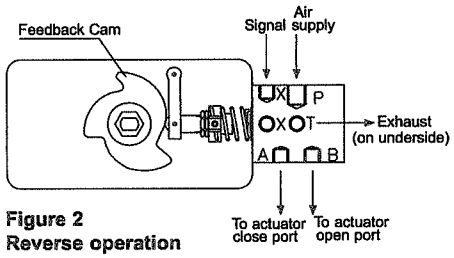


Figure 2
Reverse operation

Operation

Mounting to F79U, F79E, F790 and F796 series actuators

1. For standard direct action operation (increasing signal to open actuator), ensure that theactuator is in its CLOSED (fully clockwise) position, and that the flats on top of the positionershaft are at right angles to the longitudinal axis of the positioner.For reverse action (increasing signal to close actuator), ensure that the actuator is in its OPEN(fully anti-clockwise) position and that the flats on top of the positioner shaft are parallel to thelongitudinal axis of the positioner.
2. Fit the positioner to the top face of the actuator, using the correct mounting kit, so that thelongitudinal axis of the positioner is parallel to the actuator cylinder axis.
3. Ensure that the feedback cam in the positioner is correctly fitted with the correct range profilebearing against the feedback arm roller.(Positioners are stocked to suit 3-15 psig and direct action).For direct action, ensure that anti-clockwise rotation of the positioner shaft will cause the camto compress the spring.For reverse operation, ensure that clockwise rotation of the positioner shaft will cause the camto compress the spring.
4. Connect the air ports as shown in Fig. 1 for direct action and in Fig. 2 for reverse action.

Settings procedure:

In most cases the positioner will be pre-set prior to leaving the factory. If readjustment isnecessary, follow the following instructions.

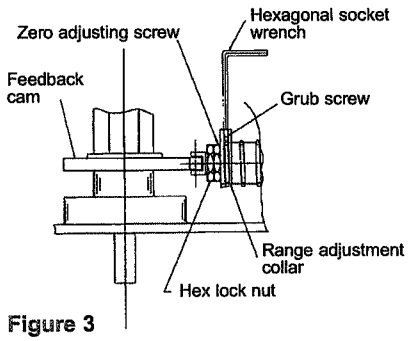


Figure 3

1. With the positioner correctly mounted to the actuator and cover removed, connect the airsupply and signal to the positioner.
2. Apply a of signal approximately 9 psig and gradually reduce this to 3 psig. If the actuator justreaches the CLOSED position as the signal reduces to 3 psig, no adjustment is necessary.
3. If the actuator does not close fully at 3 psig, turn the hexagon zero adjusting nut 1/6 of a turnclockwise and repeat step 2. Continue until zero is correctly achieved.
4. If the actuator reaches the CLOSED position before the signal reduces to 3 psig, turn thehexagon zero adjusting nut 1/6 of a turn anti-clockwise and repeat step 2. Continue until zero iscorrectly achieved.
5. Gradually increase the signal to 15 psig. If the actuator just reaches the OPEN position as thesignal reaches 15 psig, then no adjustment is necessary.
6. If the actuator does not reach the OPEN position at 15 psig, this is indicative of the spring ratebeing too high. Loosen the grubscrew in the range adjustment collar, (see Fig. 3), hold the collarstationary using a hexagon socket wrench, and turn the spring slightly clockwise. This will movethe actuator even further away from fully OPEN and the zero adjusting screw must be used toachieve fully OPEN.
7. Conversely, if the actuator reached OPEN position before 15 psig, turn the spring slightly anti-clockwise with respect to the rate adjusting collar. Again re-adjust the zero screw to achieveexact fully OPEN.

The zero and range settings are highly interactive and steps 2 to 7 must be repeated until zeroand span are acceptable.

Note! In steps 3 to 7, clockwise and anti-clockwise rotations are as viewed from the adjusting nutend of the spring.

Warning!
When Pressure Gauge is not required, fit hex head socked screw from mounting kit using proprietary none hardening sealing compound or tape. If there is a requirement to remove the socket screw for future application, an applied torque of 200 lbs/ins should not be exceeded.

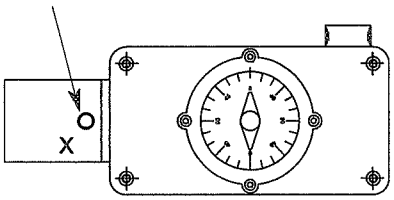


Figure 4 - Direct operation

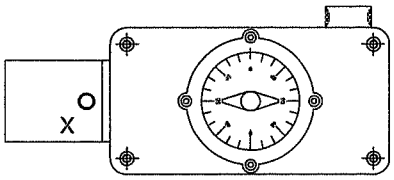


Figure 5 - Reverse operation

Cover fittings:

Ensure that the actuator is in the position corresponding to minimum signal, ie. CLOSED for directoperation (see Fig. 4) and OPEN for reverse operation (see Fig. 5).

1. Remove the position indicator cover and position indicator from the main cover.
2. Fit the main cover over the shaft and secure to the body using a captive screw in each corner.
3. Fit the position indicator to the double 'D' at the top of the shaft.
4. Fit the position indicator cover to the positioner cover so that the zero degree markings aredisposed along the transverse axis of the positioner. Before finally securing the positionindicator cover, ensure that the cover is positioned so that the arrow indicates the exactposition of the actuator.

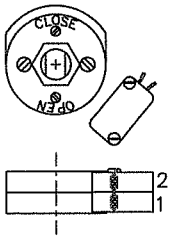
Switch details

Micro-switch details — **Standard V9 type, single pole double throw (SPDT). Switch ratings as table below**

Voltage (volts)	*Resistive load (Amps)*	*Tungsten lamp load (Amps)*		*Inductive load (Amps)*
AC				
125	10	2	1	10
250	10	1.5	1	10
DC				
Up to 15	15	3	1.5	15
30	10	3	1.5	10
50	3	0.8	0.8	2.5
75	1	0.6	0.6	0.5
125	0.5	0.5	0.5	0.07
250	0.25	0.25	0.25	0.03

Proximity switch details

Type	Pepperl & Fuchs NJ2-V3-N or as specified
Quantity	2 switches per unit
Sensing distance	2mm maximum (metal face). NB! Separate amplifier required
supply	8V DC (R1 approx. 1kOhm)
Temperature range	-25°C to +70°C
Repetition	<0.01mm
Hysteresis	= 0.05mm Typ 3%
Output	Sensor absent - 3mA or above Sensor present - 1mA or below Switching rate - 1kHz maximum



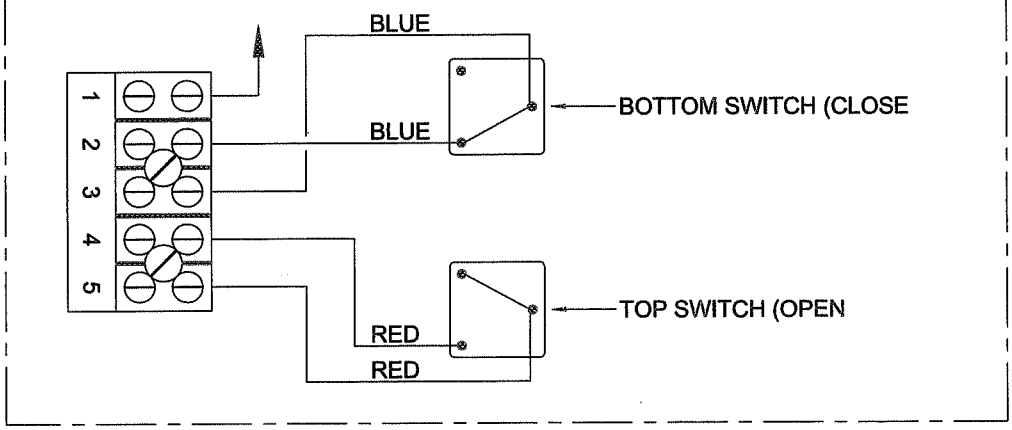
Switch indentification

Switch number	Switch function
1	close limit
2	open limit

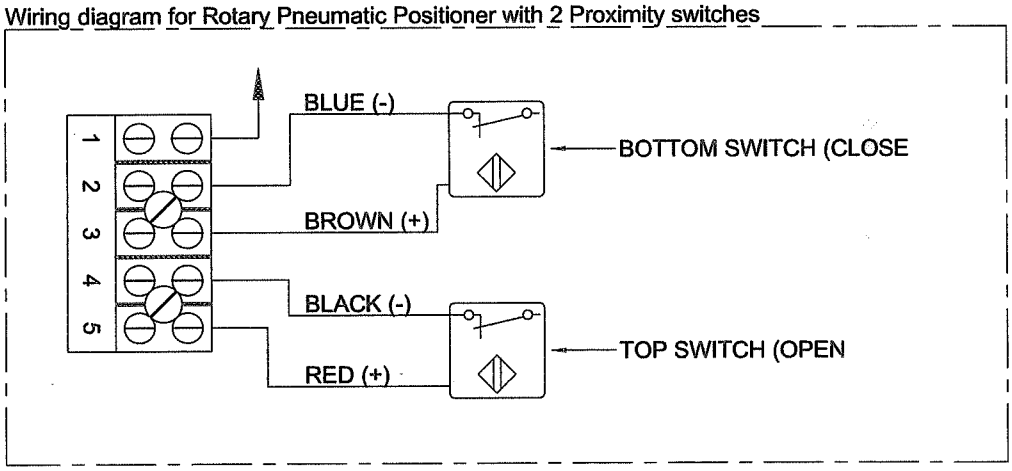
Part no: M1014-000txt Item:

Wiring diagrams

Wiring diagram for Rotary Pneumatic Positioner with 2 micro-switches



Wiring diagram for Rotary Pneumatic Positioner with 2 Proximity switches



Hamworthy Moss AS

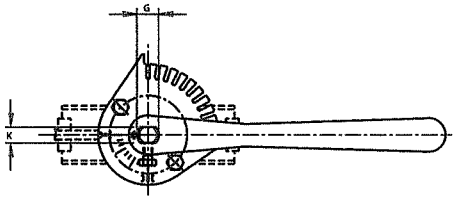
Part no: N8061-001txt Item:

Rev: 02 Date: 20070810

MANUAL OPERATORS

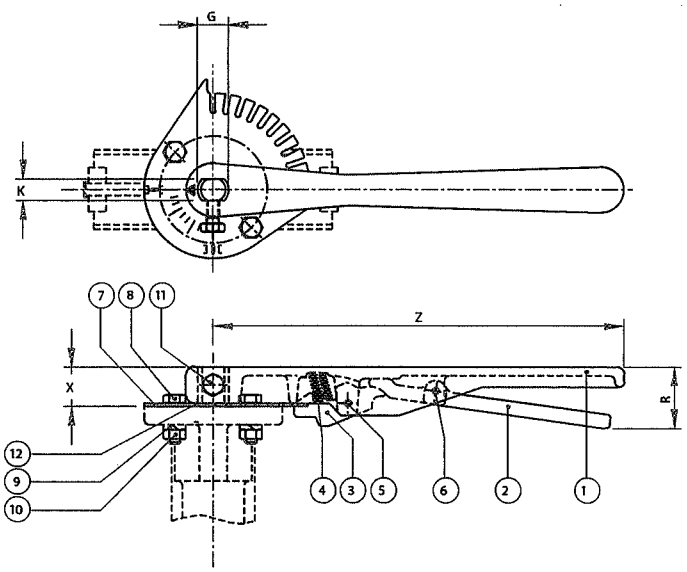
Fig. 412/413

User manual



Leverlock handle Figure 412

Part	Name
1.	Handle bar
2.	Handle lever
3.	Locking plate
4.	Spring
5.	Spring pin
6.	Spring pin
7.	Throttling plate
8.	Screw
9.	Springwasher
10.	Nut
11.	Handle screw
12.	Security plate (optional



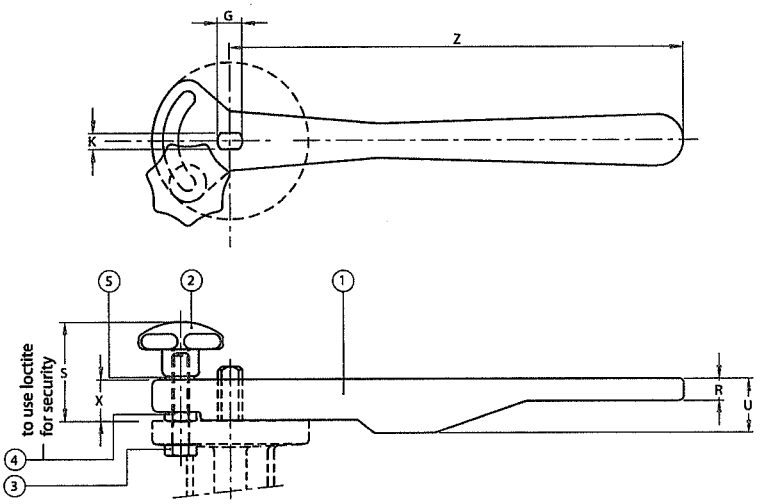
Note

1. Supplier advises to use handles for valves up to sizes 150 mm. On larger sizes, gearoperators according to F455 are recommended.

Handle dimensions in mm

Type	For sizes	G	K	R	X	Z	Mass (kg) Alu	Mass (kg) Ductile Iron
412-015	20-50	12,03	08,03	35	25	180	0,2	0,6
412-025	65-100	16,03	11,03	41	30	267	0,5	1,1
412-050	125-150	20,03	14,03	41	30	267	0,5	1,1
412-080	200	25,03	18,03	50	50	356	-	2,1
412-100	250-300	30,03	22,03	50	50	356	-	2,1

Continuous adjustable handle Figure 413



Part	Name
1.	Handle bar
2.	Star gripcap
3.	Screw
4.	Nut
5.	Serrated lock washer
6.	Security plate

Note

1. Supplier advises to use handles for valves up to sizes 150 mm. On larger sizes, gearoperators according F455 are recommended.

Handle dimensions in mm

Type	For sizes	G	K	R	S	U	X	Z	Mass (kg)
413-015	20-50	12,03	8,03	9	48	26	20,0	180	0,6
413-025	65-100	16,03	11,03	13	60	32	24,5	267	1,1
413-050	125-150	20,03	14,03	13	60	32	24,5	267	1,1

Material selection Figure 412

Handle bar	Handle lever	Throttling plate	Locking plate	Mounting mat.	Security plate	Trim no.	Sizes (mm)
Aluminium	Aluminium	Steel zinc coated	Steel zinc coated	Steel	-	511	20-150
					Stainless Steel	515	20-150
Aluminium anodized	Aluminium anodized	Stainless Steel	Stainless Steel	Stainless Steel	-	513	20-150
					Stainless Steel	517	20-150
Ductile Iron	Ductile Iron zinc coated	Stainless Steel	Stainless Steel	Stainless Steel	-	514	20-300
					Stainless Steel	518	20-300
Ductile Iron	Ductile iron	Steel zinc coated	Stainless Steel	Steel	-	512	20-300
					Stainless Steel	516	20-300

Material specification Figure 412

Part name	Material	DIN designation	DIN mat. no.	Remark
Handle bar	Aluminium	GD-AlSi8Cu3	3.2161.05	Alloy number 226
	Ductile Iron	GGG 40	0.7040	
	Aluminium anodized	GD-AlMg8(Cu) anodized	3.2161.05	Alloy number 226 anodized
Handle lever	Aluminium	GD-AlSi8Cu3	3.2161.05	Alloy number 226
	Ductile Iron	GGG 40	0.7040	
	Ductile Iron/ zinc coated	GGG 40 zinc coated	0,7040 zinc coated	
	Aluminium anodized	GD-AlMg8(Cu) anodized	3.2161.05	Alloy number 226 anodized
Locking plate	Steel zinc coated	St 12.03/St 37 zinc coated		
	Stainless Steel	X 5 CrNi 18 10	1.4301	
Spring	Stainless Steel	X 5 CrNiMo 17 12 2	1.4401	
Springpin	Stainless Steel	X 5 CrNi 18 10	1.4301	
Throttling plate	Steel zinc coated	St 12.03/St 37 zinc coated		
	Stainless Steel	X 5 CrNi 18 10	1.4301	
Screw	Steel			Quality 8.8
	Stainless Steel	X 5 CrNi 18 10	1.4301	
Springwasher	Steel			
	Stainless Steel	X 5 CrNi 18 10	1.4301	
Nut	Steel			Quality 8.8
	Stainless Steel	X 5 CrNi 18 10	1.4301	
Handle screw	Stainless Steel	X 5 CrNi 18 10	1.4301	
Security plate	Stainless Steel	X 5 CrNi 18 10	1.4301	Figure 412-S only

Material selection Figure 413

Handle bar	Star grip	Trim no.	Sizes (mm)
Ductile Iron	Bakelite with steel insert	523	20-150

Material specification Figure 413

Part name	Material	DIN designation	DIN mat. no
Handle bar	Ductile Iron	GGG 40	0.7040
Star gripcap	Bakelite + Steel insert		
Screw	Stainless Steel	X 5 CrNiMo 17 12 2	1.4401
Nut	Stainless Steel	X 5 CrNi 18 10	1.4301
Washer	Stainless Steel	X 5 CrNiMo 17 12 2	1.4401

Hamworthy Moss AS

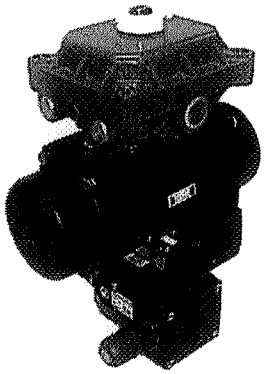
Part no: N0040-001txt Item:

Rev: 02 Date: 20050606

NAMUR SOLENOID VALVE

Fig. 791B

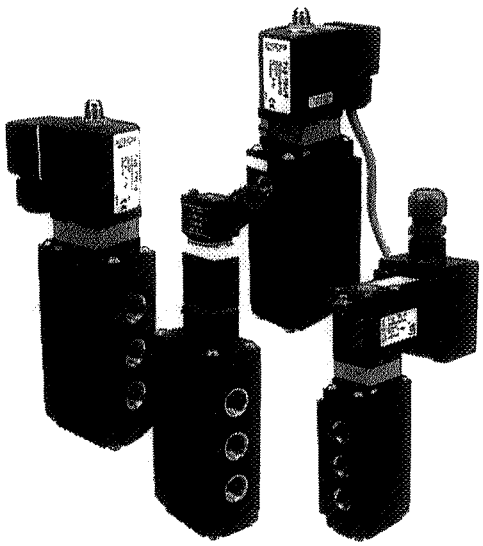
Instructions



A high flow pilot operated solenoid valve for direct mounting to the makers range of pneumatic actuators.

Features

- Compact design, constructed on the diaphragm operated poppet valve principle.
- Positive sealing and high air flow characteristics.
- Low wear and maintenance through non lube characteristics.
- 5/2 or 3/2 selectable via adaptor plate
- Slip-over coil (rotatable with fixed positions)
- Dual frequency a/c coil (50/60Hz)
- Valves for either 3 or 5 way control are available with single or double solenoid operation.
- 3/2 operation provides purge function to actuator spring chamber, ensuring aggressive environments are unable to enter the actuator.
- Positive sealing even at sub zero temperatures with dry air (-10°C).
- Lubricated or non-lubricated air.
- Constructed from corrosion resistant, lightweight plastic.
- Low power consumption.
- Manual override, as standard, latchable or non-latchable.
- Explosionproof. Type 'ed', 'm' and 'Intrinsically Safe Versions' are also available.
- Weatherproof to IP65 rating.
- Meets international accepted NAMUR standard.
- Cable entry: 1-off DIN plug with Pg 16 cable gland for IP65.
- Every unit is factory tested.



General

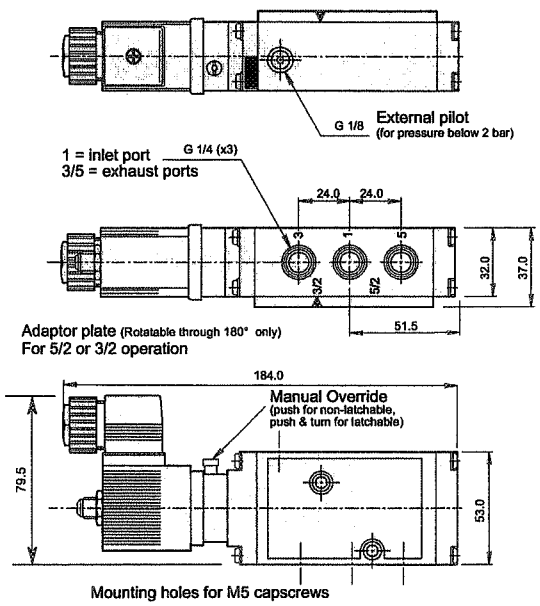
The makers expertise and ability in advanced engineering technology has been applied to this comprehensive range of direct mounted solenoid valves

Hamworthy Moss AS

Part no: N0040-001txt Item:

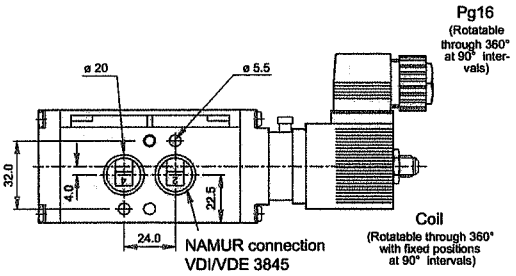
Dimensions

- Standard weatherproof version - IP65



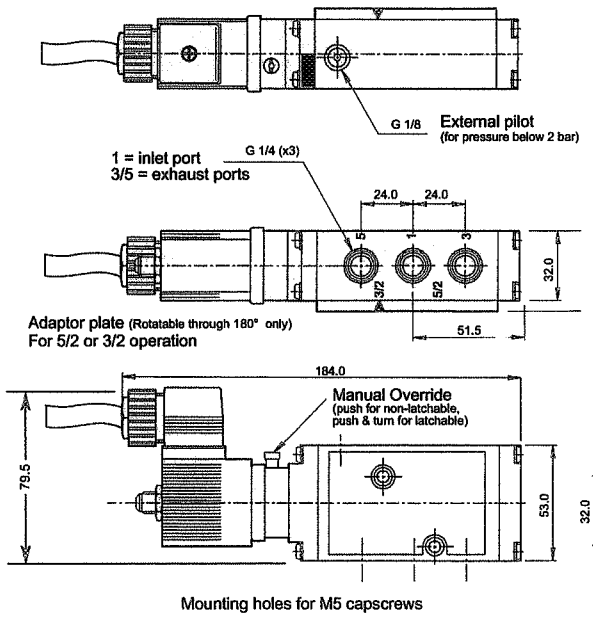
Specifications:

- **Coil Weatherproof** IP65
- **Material** Polyamide
- **Standard Coil Voltages** A.C. 24, 115, 230 (50 & 60 Hz) D.C. 24.
- **Connection** Pg16
- **Pressure range** 2 bar to 8 bar.
- **CV** 0.97(QNn=900 l/min)
- **All coils continuously rated.**
- **Max. permitted voltage variation±10%.**
- **Max. ambient temperature** 50°C.
- **Power consumption** A.C. Inrush - 11VA.
  Hold - 6VA.
  D.C - 2.0 Watts



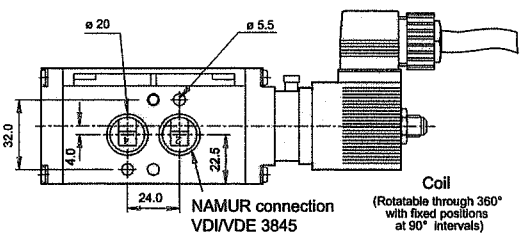
Dimensions

- Explosionproof version - E Ex m II T5



Specifications:

- **Coil Explosionproof** E Ex m II T5
- **Material** Epoxy
- **Standard Coil Voltages** AC/DC 24, 115, 230 (50 & 60 Hz)
- **Connection** 3m flying lead
- **Max. ambient temperature** 50°C.
- **Power consumption** 3 Watts



Hamworthy Moss AS

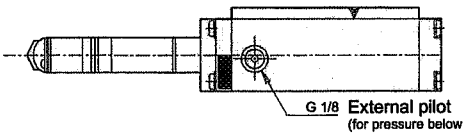
Part no: N0040-001txt Item:

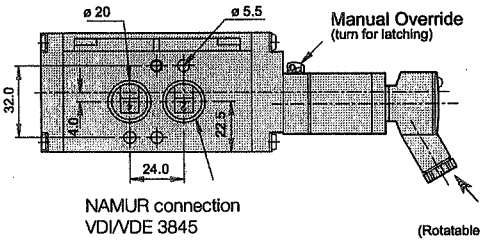
Specifications:

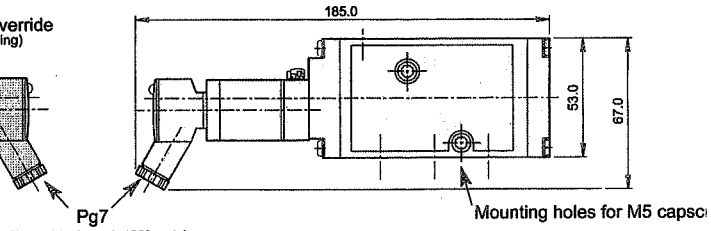
- **Coil Intrinsically safe** E Ex ia II T6
- **Material** Epoxy
- **Connection** Pg 7
- **Max. ambient temperature** 50°C.
- **Power consumption** 0.5 Watts

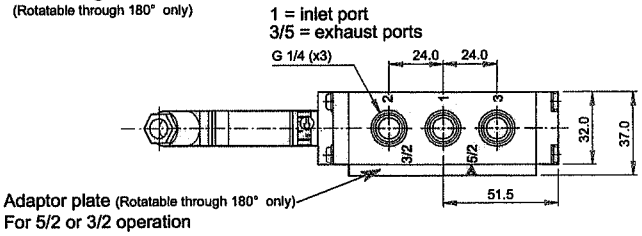
Dimensions

- Intrinsically safe version - E Ex ia IIC T6







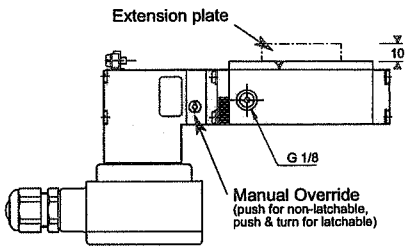


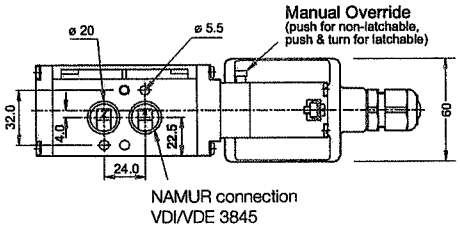
Specifications:

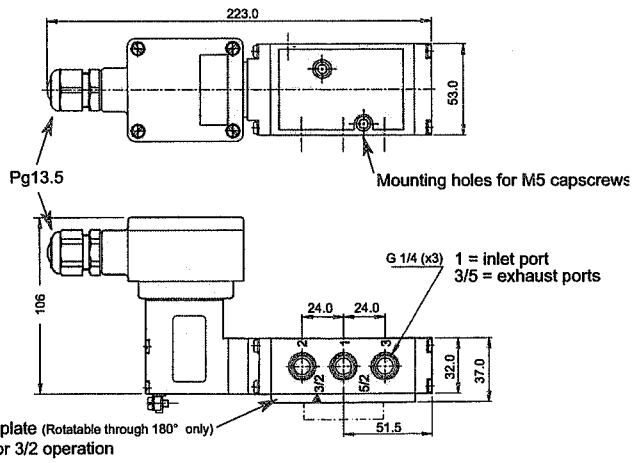
- **Coil Explosionproof** E Ex ed IIC T5
- **Material** Epoxy
- **Standard Coil Voltages** A.C. 24, 115, 230 (50 & 60 Hz) D.C. 24.
- **Connection** Pg 13.5
- **Max. ambient temperature** 50°C.
- **Power consumption** 5 Watts

Dimensions

- Explosionproof version - E Ex ed IIC T5







Hamworthy Moss AS

Part no: N0040-001txt Item:

Technical Data:

Operating pressure: 2 - 8 bar g max., Cv (flow factor) 0.97

Port size: ISO 228 - $G^1/_4$

Electrical characteristics:

Standard coil voltage: AC 24, 115, 230. DC 24.

Non-standard voltages are available on request.

All coils continuously rated.

Maximum permitted voltage variation ± 10%.

Maximum ambient temperature 50° C

Minimum ambient temperature -10° C

Electrical connections:

- Plug and socket (standard) to DIN 43650 Form A Pg 16 for IP65 coil.
- Junction box Pg 13.5 for EEx e d.
- Flying lead for EEx m.
- Plug and socket (standard) to DIN 43650 Form C Pg 7 for EEx ia.

Optional extras:

- Cable plug with LED and Varistor
- Remote mounted solenoid.
- Valve islands
- Profibus/Devicenet/ASI Fieldbus Interfaces.

Material of Construction

Valve bodies - Polyamide PA

Pilot valve, armature & stopper - 1.4105

Guide tube - 1.4303

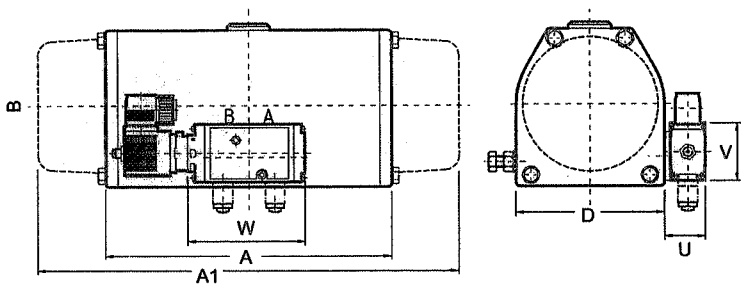
Springs - 1.4310

Seals - PB (NBR & PUR)

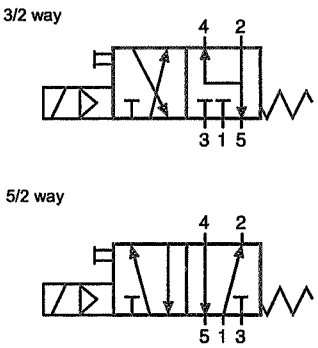
Inserts - MS (nickel plated)

Bolting - Steel (cadmium plated)

Media - Lubricated or non lubricated compressed air, instrument air or nitrogen



Valve operating diagrams



Valve is supplied pre-set for 3 or 5 way operation. The function is changed by rotating the adaptor plate by 180°.

3 - way - plate arrows indicating 3/2

5 - way - plate arrows indicating 5/2

Dimensions (mm)

Actuator	A	A1	B	D	U	V	W
79D/79U/79E-002	116	183	81	79	37	53	108
79D/79U/79E-003	142	209	81	79	37	53	108
79D/79U/79E-006	167	257	103	93	37	53	108
79D/79U/79E-012	181	282	127	112	37	53	108
79D/79U/79E-024	233	351	150	136	37	53	108
79D/79U/79E-036	273	422	175	152	37	53	108
79D/79U/79E-065	325	500	217	203	37	53	108
79D/79U/79E-090	409	584	217	203	37	53	108
79D/79U/79E-180	480	684	278	190	37	53	108

Hamworthy Moss AS

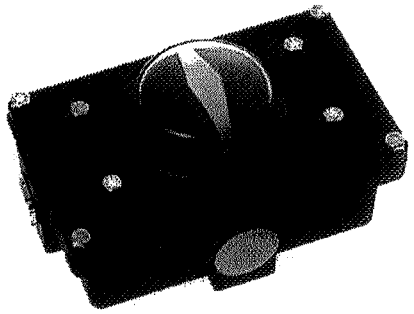
Part no: N0038-001txt Item:

Rev: 02 Date: 20050606

LIMIT SWITCH BOX

Fig. 792

User manual



The well proven design of the F792 Low Profile Switchbox has been upgraded to simplify switch setting, site wiring and weatherproof integrity.

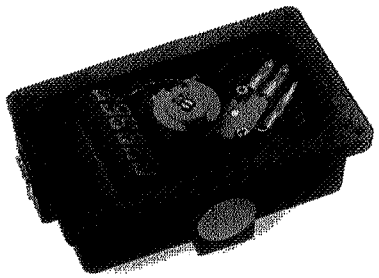
Features

- Suitable for direct mounting to all the makers actuators
- Simple screw driver cam setting.
- Independently, top adjustable cams, accessible at all angles of opening.
- Infinitely adjustable.
- Cams firmly locked after adjustment.
- Cams specially designed to operate either V9 microswitches or proximity sensors.
- Switches prewired to terminal strip.
- Cable entries: 2-off Pg 13.5.
- General purpose weatherproof enclosure to IP65 rating.
- Anodised and ESPC* aluminium enclosure provides full environmental protection.
- Readily adaptable to suit all rotary actuators.
- Terminal strip angled for easy wiring.
- Improved clearly visible local indicator.
- Direct mounted High Visibility Indicator - optional.

* Electro static powder coating.

General application

The low profile switchbox is designed for direct mounting onto the full range of the makers pneumatic actuators. The direct coupling to the actuator shaft ensures an accurate representation of valve position.



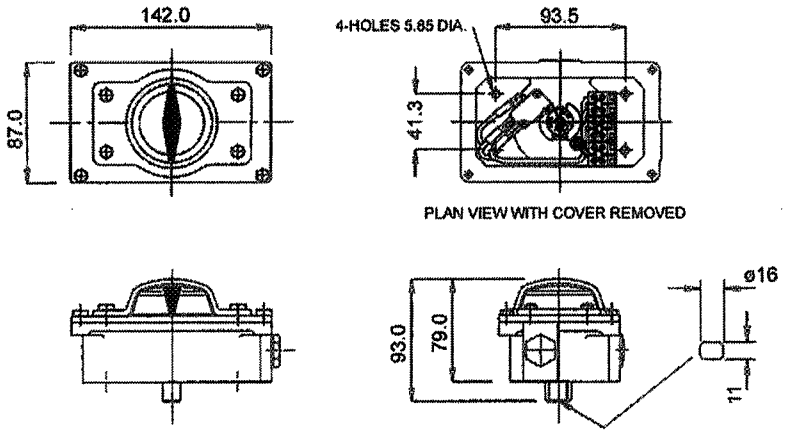
Options

1. Low profile switchbox with two V9 microswitches.
2. Low profile switchbox with inductive proximity sensors.

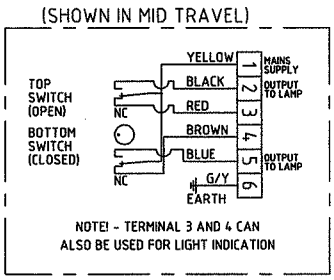
Hamworthy Moss AS

Part no: N0038-001txt Item:

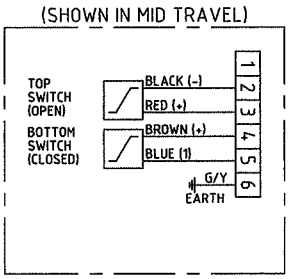
Dimensions -Standard



Wiring diagrams



OPTION 1. low profile switchbox with two V9 microswitches



OPTION 2. low profile switchbox with two inductive proximity sensors

Ratigns for V9 microswitches

Voltage (volts)	Resistive load (amps)	Tungsten lamp load (amps9 NC	NO	Inductive load (amps)
AC				
125	10	2	1	10
250	10	1.5	1	10
DC				
Up to 15	15	3	1.5	15
50	3	0.8	0.8	2.5
75	1	0.6	0.6	0.5
125	0.5	0.5	0.5	0.07
250	0.25	0.25	0.25	0.03

Proximity switch details

Type:	Pepperl & Fuchs NJ2-V3-N or as specified
Sensing distance:	2mm maximum (metal face). NB. Seperate amplifier required.
Supply:	8V DC (Ri approx. 1kOhm)
Repetition:	<0.01mm
Hysteresis:	<0.05mm Typ 3%
Output:	Sensor absent - 3mA or above Sensor present - 1mA or below Switch rate - 1kHz maximum

Materials of construction

Body:	die cast aluminium LM24 (anodised and ESPC*)
Cover:	die cast aluminium LM24 (anodised and ESPC*)
Dome:	Ektar (DN004 copolyester)
Cams:	acetal
Shaft:	acetal
Position:	A.B.S. - (acrylanitrile
Indicator:	butadene styrene)

* Electro static powder coating.

Operation specification

Temperature range: -25°C to + 70°C

Enclosures

All switchboxes are weatherproof to IP65 mimimum.

Hamworthy Moss AS

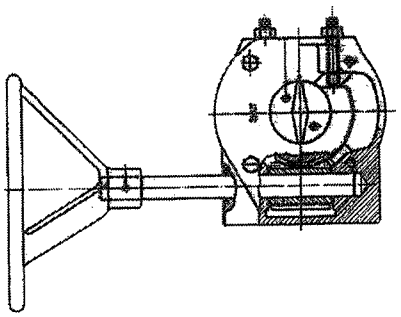
Part no: N0039-001txt Item:

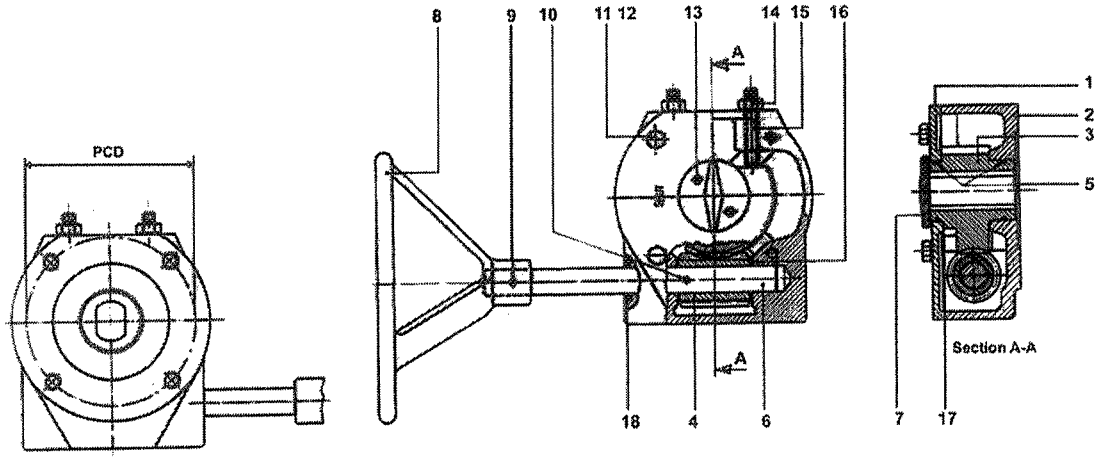
Rev: 02 Date: 20050606

GEARUNIT

Fig. 455

User manual





Part	Name	Material
1.	Cover	Cast Iron GG 25
2.	Housing	Cast Iron GG 25
3.	Quadrant	Ductile Iron GS 400
4.	Worm	Carbon Steel PR 80
5.	O-Ring	NBR
6.	Input Shaft	Stainless Steel AISI 303
7.	Position Cap	Cast Iron GG 25
8.	Handwheel	Cast Iron GG 25
9.	Roll Pin	Carbon Steel C.72
10.	Roll Pin	Carbon Steel C.72
11.	Cover Screw	Carbon Steel 8.8
12.	Lock Washer	Carbon Steel C.72
13.	Position Cap	Screw Nickel Plated C.15
14.	Nut	Carbon Steel 6S
15.	Stop Screw	Carbon Steel PR 80
16.	Thrust Bearing	Carbon Steel C.70
17.	Gasket	Guarnital
18.	Shaft Seal	NBR

Gearunit data in mm

Type	PCD	Thread dia	Number of holes	Shafthole diameter	keysize
GM 20	50/70	M6/M8	4	20 x 14 flat	F-05/f-07
GM 60	125	M12	4	30 x 22 flat	F-12
GM 90	125	M12	4	35 x 10 key	F-12
GM 150	165	M20	4	50 x 14 key	F-16
GM 240	165	M20	4	50 x 14 key	F-16
GM 500	165/254	M20/M16	4/8	70 x 20 key	F-16/F-25
GM 500 SG	165/254	M20/M16	4/8	70 x 20 key	F-16/F-25

Torque values in Nm

Type	Ratio	Max. output torque	Input torque	Handwheel (ø)
GM 20	36	226	38	150
GM 60	40	678	96	300
GM 90	63	1243	126	300
GM 150	78	2373	149	300
GM 240	68	3390	212	450
GM 500	80	7457	378	600
GM 500 SG	160	7457	240	600

1. Specify part no., figure no. and type when ordering spareparts
2. GM-080 internals are mounted in a GM-090 housing

Hamworthy Moss AS

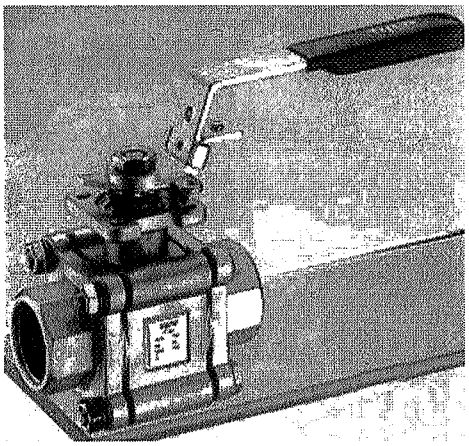
Part no: N8083-001txt FG: Item: 53

Rev: 01

Date: 20060110

BALL VALVE

F180



A comprehensive range of Utility Ball Valves to suit a wide range of general industrial applications

Features

- The range includes one, two and three piece ball valve designs with screwed, weld or flanged end connections.
- 3/4/5-way multi-port designs available.
- ISO 5211 top mounting plate available, for easy actuation, on selected models.
- Body construction either investment or sand cast according to model.
- Carbon steel or stainless steel body materials.
- Wide range of pressure ratings available.
- Reduced and full bore models.
- Locking facilities on all models.
- Seat material options available.
- Firesafe models available

Technical data	
Sizes (inch) Sizes (mm)	1/4 - 12 DN8 to DN300
Pressure ratings	55, 70, 100 bar PN10/16, PB25/40, PN63 ANSI 150/300
End connections Screwed	BSPP, BSPT, NPT
Socket & Butt Weld Flanged	ANSI 150/300 PN10/16, PN25/40
Special connections on request	

Application

The range includes valves ideal for general industrial and service applications including water, oil, gas and chemical processes. Certain models also offer designs suitable for more hazardous services such as fuel and inflammable substances.

F180/F180F - Three-piece heavy duty ball valve

- With ISO 5211 top mounting plate and fully enclosed bolting
- End connections screwed, butt weld or socket weld
- Carbon steel or stainless steel bodies
- F180F Fire safe tested to API 607

Size range

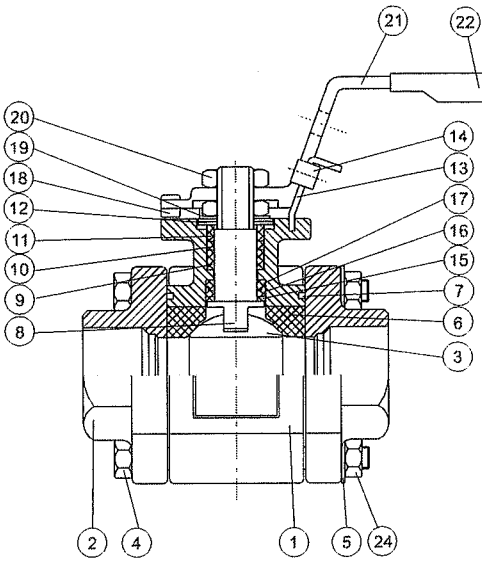
F180 - DN8 (1/4") to DN100 (4")

F180F - DN10 (3/8") to DN80 (3")

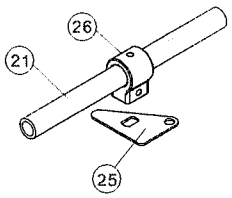
- Full Bore and Reduced Bore

Hamworthy Moss AS

Part no: N8083-001txt Item:



Sizes DN8-DN80 (1/4 "-3")



Handle for valve
Size DN 100 (4 ")

Features

- Heavy duty, three piece ball valve
- Patented "Sealmaster" stem arrangement
- Double stem sealing complies with TA-LUFT requirements
- ISO 5211 top mounting plate
- Blow out proof stem and antistatic design
- Fully enclosed bolting for sizes up to DN40 full bore
- End connections, screwed, butt weld and socket weld
- Carbon steel and stainless steel bodies
- Tightness to ISO 5208 cat. A
- Seat material options
- Optional castings per AD/WO/TRD-100 are available
- Size range DN8 (1/4") to DN100 (4") - Full and reduced bore

Materials of construction

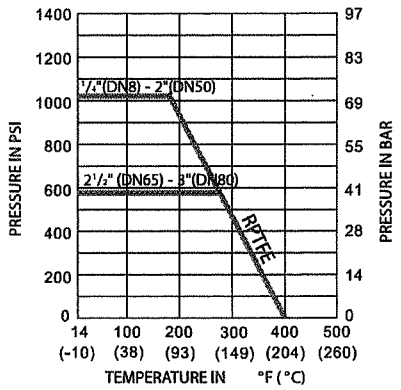
No.	Part Name	Material	Quantity
1	Body	CF8M / WCB, 1.4408 / 1.0619	1
2	Cap	CF8M / WCB, 1.4408 / 1.0619	2*
3	Ball	ASTM A351 Gr. CF8M	1
4	Bolt	A2-70	4-6
5	Bolt Washer	SUS304 / S45C	4-6
6	Ball Seat	RPTFE	2
7	Body Gasket	PTFE	2
8	Anti-Static Stem	A276 Type 316	1
9	V-Ring Stem Packing	PTFE	1 Set
10	Trust Washer	50% S.S Powder / 50% PTFE	1
11	Gland	SUS304	1
12	Belleville Washer	SUS301 / 1075	2
13	Locking Trigger	SUS304	1
14	Fix Plate	SUS304	1
15	Lower Stem Seal	50% S.S Powder / 50% PTFE	1
16	Compress Ring	SUS316	1
17	Upper Stem Seal	TFM1600	1
18	Stop Bolt	A2-70	1
19	Lock Saddle	SUS304	1
20	Stem Nut	SUS304	2
21	Handle	CF8 / Steel	1
22	Handle Sleeve	Vinyl	1
23	Rivet	SUS304	2
24	Bolt Nut	A2-70	4-12
25	Triangle Stopper	SUS304	1
26	Handle Adapter	ASTM A351 Gr. CF8	1

* Stainless steel welded connectors are CF3M/1,4409

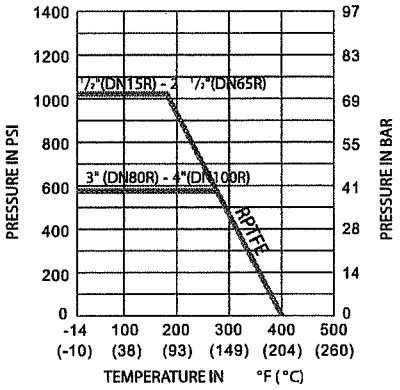
Hamworthy Moss AS

Part no: N8083-001txt Item:

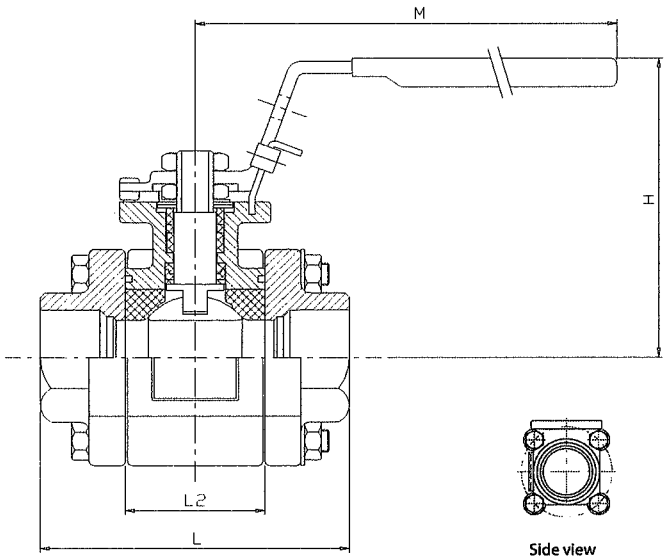
Pressure/Temperature charts

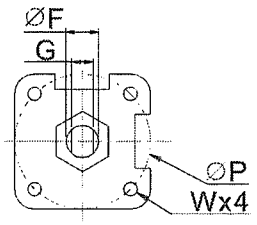


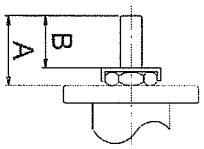
Full Bore Sizes



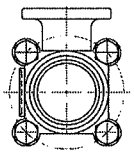
Reduced Bore Sizes



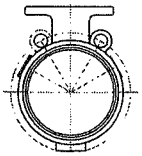




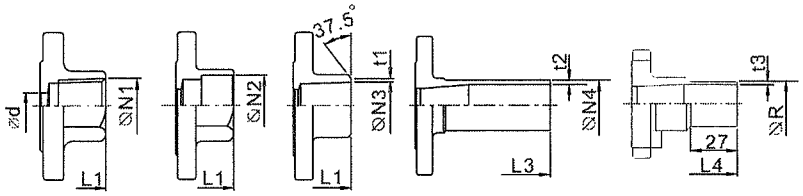
Side view
Full bore:
DN10 (3/8 ")
Reduced bore:
DN15 (1/2 ")



Side view
Full bore:
DN15-DN40 (1/2 "-1 1/2 ")
Reduced bore:
DN20-DN50 (3/4 "-2")



Side view
Full bore:
DN50-DN80 (2 "-3")
Reduced bore:
DN65-DN100 (2 1/2 "-4")



Threaded end | Socket weld | Butt weld | SCH#5(FP)/ SCH#10(FP) | NW(RP)/ RJT(RP)

Hamworthy Moss AS

Part no: N8083-001txt Item:

Full Bore Dimensions (mm)

Size	DN	Ød	A	B	G	ØP	ØF	W	M	t1	t2		L1	L2	L3	ØN2	ØN3	ØN4	H	Wt(kg)
											5S	10S								
1/4"	8	11.2	12.7	5.6	5.0	36	7.9	M5/Ø5.5	115	0.5	N/A	N/A	66.6	21.2	N/A	14.1	10.2	N/A	66	0.62
3/8"	10	12.7	12.7	5.6	5.0	36	7.9	M5/Ø5.5	115	0.5	N/A	N/A	66.6	21.2	N/A	17.5	13.5	N/A	66	0.60
1/2"	15	15.0	18.0	9.0	6.3	42	9.7	M5/Ø5.5	135	0.5	1.65	2.1	71.6	25.2	129.8	22.4	16.8	21.7	84	0.82
3/4"	20	20.0	17.5	9.0	6.3	42	9.7	M5/Ø5.5	135	0.5	1.65	2.1	96.6	32.3	140.9	27.4	22.0	27.2	88	1.42
1"	25	25.0	20.0	12.0	8.0	50	11.2	M6/Ø6.5	165	0.5	1.65	2.1	109.0	42.3	223.3	34.2	27.6	34.0	98	2.02
1 1/4"	32	31.8	20.0	12.0	8.0	50	11.2	M6/Ø6.5	165	0.5	1.65	2.8	117.0	49.4	230.4	43.0	36.1	42.7	101	2.76
1 1/2"	40	38.1	23.5	14.0	9.5	70	16.0	M8/Ø8.5	200	0.5	1.65	2.8	129.0	57.2	240.2	49.0	41.9	48.6	117	4.12
2"	50	50.8	23.5	14.0	9.5	70	16.0	M8/Ø8.5	200	1.0	1.65	2.8	142.0	71.4	259.4	61.1	54.5	60.5	125	6.00
2 1/2"	65	65.0	41.5	24.7	17.0	102	22.2	M12/Ø13.5	250	1.0	N/A	N/A	174.0	89.0	N/A	77.1	70.9	N/A	164	9.48
3"	80	80.0	38.5	25.7	17.0	102	22.2	M12/Ø13.5	250	1.6	N/A	N/A	193.0	108.5	N/A	90.2	81.1	N/A	173	15.64

ØN1:BSPP, BSPT, NPT

N/A= Not Available

Reduced Bore Dimensions (mm)

Size	DN	Ød	A	B	G	ØP	ØF	W	M	t1	t3		L1	L2	L4	ØN2	ØN3	H	ØR		Wt(kg)
											NW	RJT							NW	RJT	
1/2"	15	12.7	12.7	5.6	5.0	36	7.9	M5/Ø5.5	115	0.5	1.5	1.6	66.6	21.2	136	22.4	16.8	66	18	12.7	0.63
3/4"	20	15.0	18.0	9.0	6.3	42	9.7	M5/Ø5.5	135	0.5	1.5	1.55	71.6	25.2	133	27.4	22.0	82	22	19.0	0.85
1"	25	20.0	17.5	9.0	6.3	42	9.7	M5/Ø5.5	135	0.5	1.5	1.6	96.6	32.3	151	34.2	27.6	86	28	25.4	1.48
1 1/4"	32	25.0	20.0	12.0	8.0	50	11.2	M6/Ø6.5	165	0.5	1.5	N/A	109	42.3	163	43.0	36.1	98	34	N/A	2.08
1 1/2"	40	31.8	20.0	12.0	8.0	50	11.2	M6/Ø6.5	165	0.5	1.5	1.6	117	49.4	182	49.0	41.9	100	40	38.1	2.82
2"	50	38.1	23.5	14.0	9.5	70	16.0	M8/Ø8.5	200	1.0	1.5	1.65	129	57.2	189	61.1	54.5	116	52	50.8	4.32
2 1/2"	65	50.8	23.5	14.0	9.5	70	16.0	M8/Ø8.5	200	1.0	2.0	1.6	142	71.4	236.5	77.1	70.9	125	70	63.5	5.89
3"	80	65.0	41.5	24.7	17.0	102	22.2	M12/Ø13.5	250	1.6	2.0	1.6	174	89.0	260	90.2	81.1	162.8	85	76.2	9.63
4"	100	80.0	38.5	25.7	17.0	102	22.2	M12/Ø13.5	250	1.6	2.0	2.1	193	108.5	290	115.1	105.5	170.8	104	101.6	15.44

ØN1:BSPP, BSPT, NPT

N/A= Not Available

Installation

1. **Use**

   Long life of valves can be maintained under normal working conditions and in accordance with pressure/temperature and corrosion data chart.

2. **Manual operations**

   The opening and closing of the valve is done by turning the handle 1/4 turn (90° turn).

   A. Valve in open position

   The handles is in line with the valve or pipeline.

   B. Valve in closed position

   The handle is perpendicular with the pipeline.

3. **General information for on-site installation**

3.1. The valve may be fitted in any position on the pipeline.

3.2. Before installating the valves, the pipes must be flushed clean of dirt, burrs and welding residues to prevent damage to the seats and ball surface.

3.3. The pipeline must be free of tension.

4. **Installation of threaded valves**

4.1. Use conventional sealant, such as hemp core, PTFE, etc. on the threads.

4.2. Apply wrench on the hexagon end of valve only. Tightening by using the valve body or handle can seriously damage the valve.

4.3. For applications where screwed end valves are back-welded on site, these valves must be dismantled according to instructions for weld end valves.

5. **Installation of weld-end valves**

5.1. Tack-weld the valve on the pipe in four points on both end caps, with the ball valve in open position, extended butt-weld end ball valve allows direct welding.

* for short butt-weld or socket-weld end, proceed with nest steps.

5.2. Follow procedure 1.2 under Maintenance and swing out the valve body. Secure seats from falling with tape.

5.3. Finish welding both end caps on the pipe.

5.4. When cooled down, clean both end caps and body surface.

5.5. Swing the body back in position and replace the bolts. Tighten all nuts slightly. This operation is very important to keep body and end caps perfectly parallel, thus, preventing distortion of the end caps.

5.6. Tighten body bolts evenly. Make sure that maximum tightening torque is observed per "bolting torque data".

5.7. Check proper operation of the valve.

Note
Due to the body gaskets on TV&C's series F180 are fully encapsulated in body groove and compress by end cap, it allows direct welding (WIP) as long as the end cap heat in the body gasket area can be controlled under 400°F during the welding process.

Maintenance

1. **Disassembly and cleaning procedures**

Caution
Ball valves can trap fluids in ball cavity when it is in closed position.

1.1. If the valve has been used to control hazardous media, it must be decontaminated before disassembly. It is recommended that the following steps be taken for safe removal and reassemble.

- Relieve the line pressure.
- Place the vale in half-open position and flush the line to remove any hazardous material from valve.
- All persons involved in the removal and disassembly of the valve should wear the proper protective clothing, such as face shield, glove, and apron, etc.

1.2. Maintenance of parts is easy, even if the valve is installed in the line:

By removing one body bolt and loosening the others, valve body can be swung out for series F150 & F170. Remove all body bolts except one and loosing the remaining one, valve body can be swung out for series F180.

1.3. Seats, gaskets, and ball can be replaced without disturbing pipe alignment: (See 2. Procedures to change ball and repair kit.)

2. Procedures to change ball and repair kit*

2.1. Swing the body per procedure 1.2 under Maintenance and place the valve in closed position.

2.2. Remove body gasket (#4) (not required for series F150 & F170), seats (#2) and the ball (#3). Inspect the ball closely for scrathes, if any, the ball should be replaced.

2.3. Reassemble the ball valve by using new seats and body gaskets. Swing the body back to original position. Tighten body bolts per torque data.

2.4. Whenever stern seal arrangements need to be changed. Follow step 1 & 2 and continued with following steps:

- Remove handle (#2), stem nut (#18), lock saddle washer (#17), Belleville washers (#16), gland (#14), bushing (#13), and stem packing (#12).
- Pull out stem (#11) and upper thrust washer (#8), compress ring (#9) and lower thrust washer from inside the valve body.
- Reassemble the stem arrangement by using new parts. Tighten stem nut per the torque data. Turn the saddle washer to engage it with stem nut and handle back.
- Check proper operation of the valve.

* Repair kit to contain all of soft parts.

Bolting torque data

Full port

Valve size		For body nut[1]			For stem nut [2]		For stem extension bolt or nut [4]		
inch	DN	Size	In-lb	Nm	In-lb	Nm	Size	In-lb	Nm
1/4"-3/8"	8-10	M6	70	8	55-65	6-7	M5	50	6
1/2"	15	M8	160	19	60-80	7-9	M5	50	6
3/4"	20	M8	160	19	60-80	7-9	M5	50	6
1"	25	M8	160	19	90-110	10-12	M6	70	8
1 1/4"	32	M10	345	39	90-110	10-12	M6	70	8
1 1/2"	40	M10	345	39	130-150	14-17	M8	160	19
2"	50	M10	345	39	130-150	14-17	M8	160	19
2" [3]	50	M12	580	66	190-210	21-24	M8	160	19
2 1/2"	65	M12	580	66	190-210	21-24	M12	580	66
3"	80	M16	1450	164	190-210	21-24	M12	580	66
4"	100	M16	1450	164	350-400	33-35	M12	580	66

Reduced port

Valve size		For body nut [1]			For stem nut [2]		For stem extension bolt or nut [4]		
inch	DN	Size	In-lb	Nm	In-lb	Nm	Size	In-lb	Nm
1/2"	15	M6	70	8	55-65	6-7	M5	50	6
3/4"	20	M8	160	19	60-80	7-9	M5	50	6
1"	25	M8	160	19	60-80	7-9	M5	50	6
1 1/4"	32	M8	160	19	90-110	10-12	M6	70	8
1 1/2"	40	M10	345	39	90-110	10-12	M6	70	8
2"	50	M10	345	39	130-150	14-17	M8	160	19
2 1/2"	65	M10	345	39	130-150	14-17	M8	160	19
2 1/2" [3]	65	M12	580	66	190-210	21-24	M8	160	19
3"	80	M12	580	66	190-210	21-24	M12	580	66
4"	100	M16	1450	164	190-210	21-24	M12	580	66
6"	150	M16	1450	164	290-310	33-35	M12	580	66

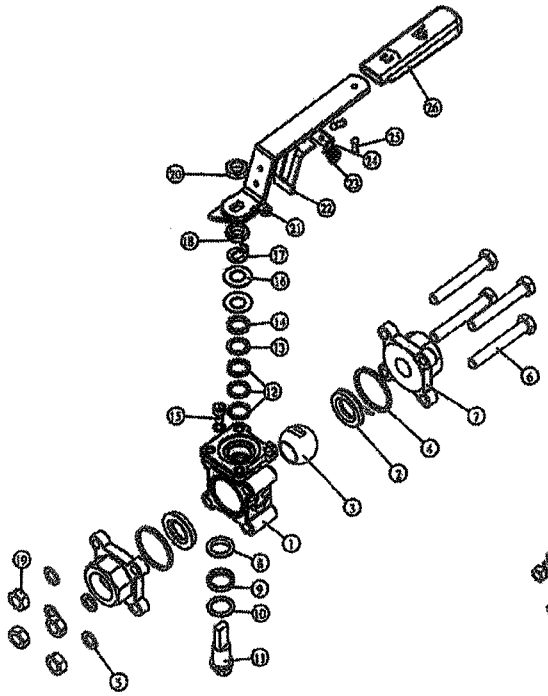
Notes

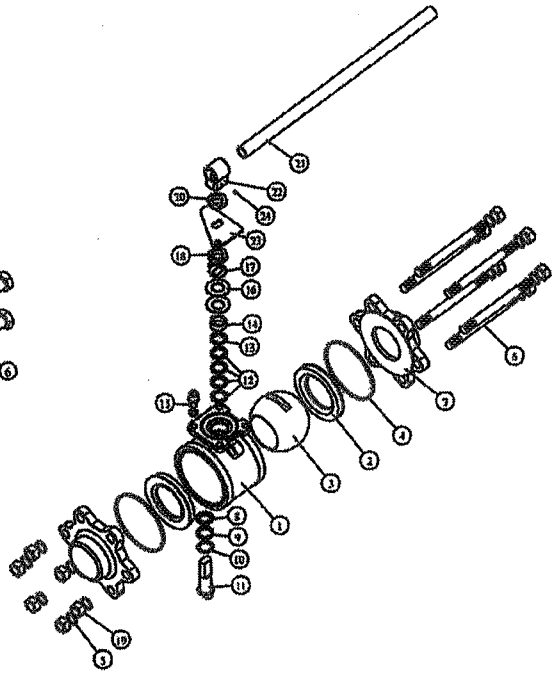
The body bolts of the valve should be tightened evenly. Tighten one-side snugly, then the one diagonally across. Repeat for the other bolts, bringing them all down tightly in sequence to the torque shown.

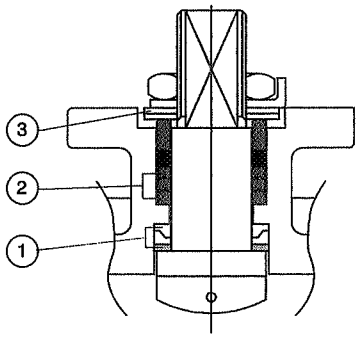
1. All body nuts are metric system
2. All stem nuts are inch system
3. For series F180
4. Stem extension to include
   - Emission leakage control unit (ELC)
   - Stem extension for actuator
   - Stem extension for piping insulation

Hamworthy Moss AS

Part no: N8083-001txt Item:







Our extremely hich cycle stem sealing design is accomplished by double sealing system. The high performance of Tyco Ball Valves is mainly due to unique SealMaster™ (1) stem seal arrangement, which provides a primary sealing. It has been specially designed and constructed to prevent line fluid permeation and resultant leakage.On top of this arrangement are multiple layers of V-Ring stem packing (2), this acts as secondary sealing.

A set of Belleville washers (3) automatically and constantly compresses the seals to adjust for wear, pressure and temperature fluctuations. Every Tyco Ball Valve is a stalwart barrier against Fugitive Emissions.

Notes

1 SealMaster™

2 V-Ring stem packing

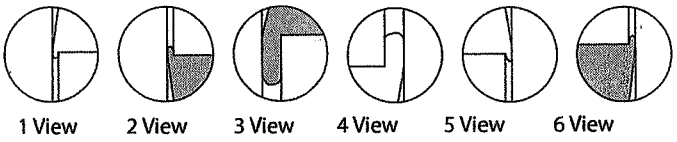
3 Belleville washers

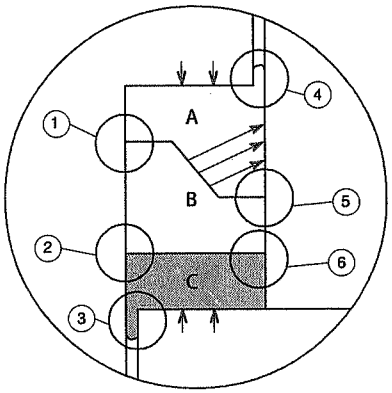
Part no: N8083-001txt Item:

Explanation of SealMaster™

The live loaded Sealmaster is a combination of 3 components; (A) a cup and cone PFA/TFE upper thrust seal, (B) a cup and cone sintered SS316 center load ring and (C) a flat SS/TFE lower thrust seal. When tightened, the live loaded stem pulls up and compressing the stem thrust seals. As this happens, material from upper and lower thrust seal extrude between stem and body enclosures (see 1-6). The surfaces between the bottom of lower thrust seal and top of stem flange are smooth and all rotation occurs between these two surfaces leaving the stem thrust seal "static" to create the best possible seal.

As rotation continues, components bed in and keep seal performance constant with usage.





Main features of SealMaster™-patented stem seal arrangement

- "Multiple" sealings up to 6 areas (see 1-6) for pressure and high vacuum.
- Encapsulated "static" sealing achieved on upper thrust seal.
- Constant sealing force transmitted to stem (see arrow) and making the stem primary sealing "positive".
- Excellent wear resistance on lower thrust seal (50% SS filled PTFE).
- Standard stem finish better than Ra 0.8µm (150 Grit) to reduce seals friction to a minimum.

Hamworthy Moss AS

Part no: N8740-001

FG: Item: 53

Rev: 00

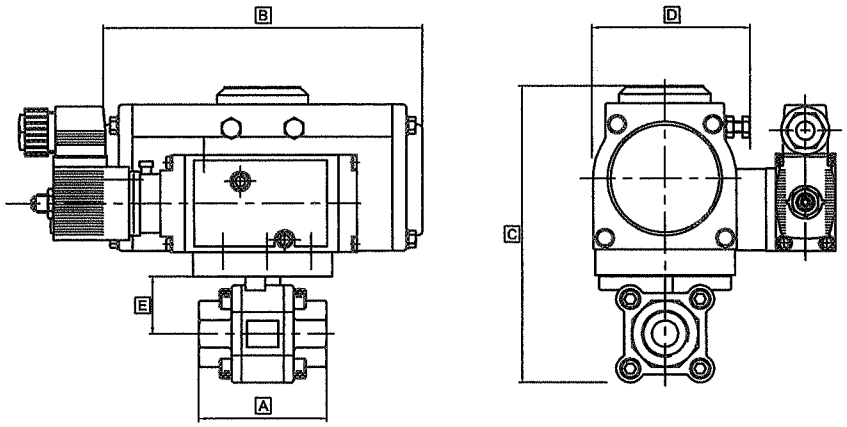
Date: 20071113

BALL VALVE ASSEMBLY

DN25 CLOSED F180

BALL VALVE	ACTUATOR	SOLENOID VALVE	CONNECT
F180 FULL BORE	PRA 002	791/B 24V DC	1" BSP

A	B	C	D	E
109	155.8	170	71	56



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Hamworthy Moss AS	Title: BALL VALVE - CLOSE ASSEMBLY DN25 - CONNECTION 1" BSP						N8740-001	Rev. 00
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Hamworthy Moss AS

Part no: N9365-001

TG: Item: 53

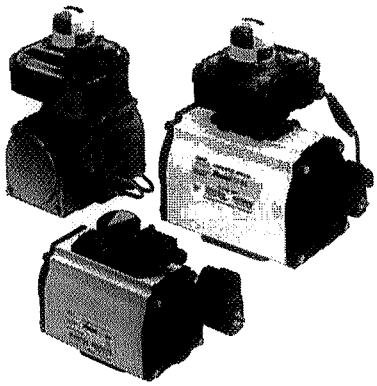
Rev: 01

TG: 153

Date: 20070821

PNEUMATIC ACTUATOR

Premiair 002



Installation and Maintenance Instructions for:

PremiAir Pneumatic Actuators

Introduction

The PremiAir Pneumatic Actuator is a compact, rack and pinion design, conforming to European and International standard EN ISO 5211 (preferred dimensions).

General Pneumatic systems recommendations

The actuator are factory lubricated with Molyrace LT2, which is a molybdenum disulphide (MoS2) grease and, unless the operating environment is extremely harsh, do not require re-lubrication. To maintain maximum efficiency with this, or other pneumatic actuators, we advise that the following basic system recommendations are followed:

- Where air pipelines are subject to extremes of temperature, the system should be fitted with suitable air drying equipment.
- Air control lines should be fitted in accordance with a 'Recommended piping practice' and should not have loops, which may trap condensate.
- All air connection pipe ends should be thoroughly cleaned and deburred after cutting, to ensure that the pipeline is clear of debris.
- If pipelines are hydraulically tested, the the lines should be "blown down" with pressurised air to clear all traces of water, prior to connecting lines to the actuator.
- Where pipe fitting sealants are used, they should be applied to the male threads only, to avoid excess compound being forced into the actuator control lines.
- Where Air Filter Equipment is used, the air filters should be situated in positions that allow easy access to maintain and/or drain.
- Where pneumatic valve positioners, or pneumatic controllers are fitted to valve actuator assemblies, oil mist lubricated air should not be used unless the manufacturer states specfically that the controllers are compatible with lubricated air.

NOTE! PremiAir actuators are rated for air pressure in the range 2.75 barg (40 psig) to 8.3 barg (120psig) and will withstand a maximum of 10.3 barg (150 psig).

Construction

Premiar actuators are designed to be mounted to quarter turn valves either directly or using the correct mounting brackets/adapters and sizing procedures.

All models are of the opposed piston type. Each piston incorporates an integral rack which engages with a one piece drive pinion shaft. The drive shaft is Nitrotech(TM) treated for maximum protection and fitted with "engineered plymer" bearings. The actuator body is of extruded aluminium, hard anodised and electrostatic powder coated. The design features bolt on mounting plate and air connection plate for maximum adaptability. O-rings are used for piston and shaft seals. For Spring return actuators, up to four springs per piston can be fitted between the

piston head and end cap to suit the available operating air pressure.

Adjustable travel stops are provided for each end of travel to ensure that the actuator will open and close the valve precisely.

The output drive is a female double square (star), conforming to EN ISO 5211.

Standard Installation - Double & Single acting units

These instructions assume that the actuators are installed with the cylinder axis parallel to the axis of the valve bore (In Line) and are fitted to Resilient Seated Butterfly Valves hanging mounting pads conforming to EN ISO 5211.

Single acting actuators are supplied as FAIL-CLOSE units as standard. Reverse acting, (FAIL-OPEN), must be specified at the time of order.

1. Ensure that the valve and actuator are in the following corresponding positions:

- Double acting units and Spring return units, (Fail-closed): Valve closed, actuator fully clockwise.
- Double acting units and Spring return units, (Fail-open): Valve open, actuator fully counter-clockwise.

Mounting to ball and high performance butterfly valves (via bracket)

2a. Secure the mounting bracket to the underside of the actuator, using four bolts and washers, as shown in Figure 1.

3a. Install the appropriate coupling onto the valve stem. The coupling should be lightly tapped or pressed onto the valve stem. The use of a lubricant is recommended.

4a. Mount the actuator and bracket onto the valve top flange using the appropriate bolts.

Mounting to resilient seated butterfly valves (with EN ISO 5211 mounting)

2b. Screw the actuator mounting studs tightly into the actuator base plate.

3b. Mount the actuator into the valve top flange and secure using a lockwasher and nut on each mounting stud.

All 1/4 turn valve types

5. Before installing the valve/actuator asssembly in a piping system, the valve operation should be verified and adjusted, if necessary, using the travel stop screws.

6. When installing the valve/actuator assembly into pipeline, ensure that the specific instructions relating to the valve installation are followed.

NOTE! Some valves may require to be fitted into the pipeline prior to mounting the actuator. Failsafe butterfly valves are an example of this

Non standard installation - Double & Single acting units

All 1/4 turn valve types

In circumstances where the actuator is required to be installed in the transverse position i.e. at ringht angles to the valve bore (across line), the actuator must be rotated through 90°. This is achieved in the following manner:

1. Remove the actuator from the valve or the bracket by removing the 4 fixing bolts/nuts and withdraw it vertically from the valve.
2. Rotate the actuator through 90°.

Refit actuator to the top of the valve or to the bracket. The output drive of the actuator is a duble square (star) design, with the squares being at 90° to each other.

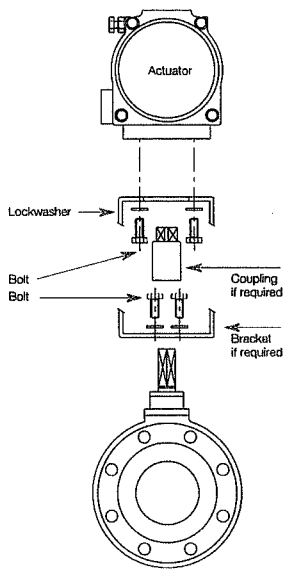


Figure 1
Typical installation on ball or high performance butterfly valves, using bracket mounting.

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Part no: N9365-001 Item:

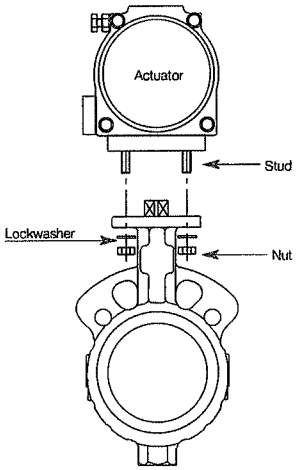
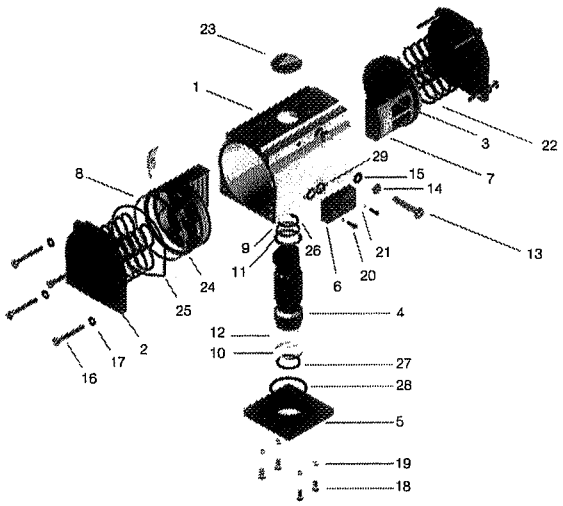


Figure 2
Typical installation on resilient seated butterfly valves, with direct EN ISO 5211 mounting.



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Part no: N9365-001 Item:

Materials of construction

NOTE!

* ESPC = Eletrostatic Powder Coating

** SNP = Special Nickel Protection finish

*** Nitrotech™ = Proprietary corrosion resistant finish

Subject	Item	Material	Finish
1	Body	Extruded Aluminium BS 1474 (6000 series)	Hard anodise + ESPC* or SNP**
2	End cap	Die cast aluminium DIN 1725 Alloy 231	Chromate + ESPC* or SNP**
3	Piston	Die cast aluminium DIN 1725 Alloy 231	Anodise or SNP**
4	Pinion shaft	Carbon steel BS 1490:1983 212 A42	Nitrotech™*** or SNP**
5	Base plate	Die cast aluminium DIN1725 Alloy 231	Chromate + ESPC* or SNP**
6	Air connection plate	Aluminium DIN 1725 Alloy 231	Chromate + ESPC* or SNP**
7	Piston backing pad	Devlon-V™	Natural
8	Piston support ring	Devlon-V™	Natural
9	Top bearing	Devlon-V™	Natural
10	Bottom bearing	Devlon-V™	Natural
11	Top spacer	Devlon-V™	Natural
12	Bottom spacer	Devlon-V™	Natural
13	Stop bolt	Stainless steel A2/70	Natural
14	Lock nut	Stainless steel A2/70	Natural
15	Sealing washer	Stainless steel A2/70	Natural
16	End cap bolt	Stainless steel A2/70	Natural

Subject	Item	Material	Finish
17	End cap washer	Stainless steel A2/ 70	Natural
18	Base plate bolt	Stainless steel A2/ 70	Natural
19	Base plate washer	Stainless steel A2/ 70	Natural
20	Air connection plate bolt	Stainless steel A2/ 70	Natural
21	Air connection plate washer	Stainless steel A2/ 70	Natural
22	Spring	Chrome Silicon spring steel BS 2806 685 A55 HD R2	Oil dip
23	Indicator	ABS	Natural
24	Piston o-ring	Rubber-NBR or FPM	Natural
25	End cap o-ring	Rubber-NBR or FPM	Natural
26	Shaft top o-ring	Rubber-NBR or FPM	Natural
27	Shaft bottom o-ring	Rubber-NBR or FPM	Natural
28	Base plate o-ring	Rubber-NBR or FPM	Natural
29	Air connection plate o-ring	Rubber-NBR or FPM	Natural

Part no: N9365-001 Item:

Dissasembly procedure

CAUTION! Remove air pressure and observe normal safety precautions, including the use of eye protection.

1. Remove travel stop bolts, (13) after slackening the lock nuts.
2. Remove end caps (2) by unscrewing the four hexagon head bolts on each end cap. For spring return versions use the progressive diagnoal method for unscrewing these bolts.
3. Using a suitable wrench in the top of the pinion shaft (4), turn the shaft counter clockwise to drive the pistons (3) apart. Remove the pistons from the body (1).
4. Remove the base plate (5) by unscrewing the four cap head bolts and spring washers.
5. The pinion shaft (4) can now be withdrawn from the bottom of the actuator body (1).
6. The top and bottom bearing rings, spacers and o-rings can now be removed from the pinion shaft or from the recesses in the body and base plate.
7. The air connection plate (69 can be removed from the body if necessary by unscrewing the two cap head bolts.
8. Remove o-rings and support rings from the piston heads.
9. Remove the backing pads from the piston legs.

Assembly procedure (refer to illustration on page 3)

1. Clean all disassembled items and replace any damaged items such as o-rings, bearings, support rings, and backing pads.
2. Grease the body bore with Molyrace LT2 lubricant.
3. Place the base plate (5) flat on the assembly bench and fit the o-ring (28) into the groove on the top face of the base plate.
4. Fit the bottom spacer (12), then the bottom bearing (10), then the bottom o-ring (27) over the bottom of the shaft and coat with Molyrace LT2 lubricant.
5. Carefully insert the shaft along with the spacer, bearing and o-ring into the base plate bore, finishing with a firm push to ensure full location.
6. Fit the top spacer (11), then the top bearing (9), then the top o-ring (26) over the top of the shaft and coat with Molyrace LT2 lubricant.
7. Carefully lower the body over the shaft and on to the base plate, finishing with a firm push to ensure that the o-ring and bearing locate fully into the top recess of the body.
8. Secure the base plate to the body using the cap head screws and spring washers (18/19).
9. Grease the pinion shaft teeth with Molyrace LT2 lubricant. Rotate the pinion shaft until the keyways, in the shaft top, are at 45 degrees as shown in the illustration (photo 1).
10. Fit o-rings (24), support rings (8) and backing pads (7) to the pistons and then grease the rack teeth using Molyrace LT2 lubricant.
11. Insert the pistons into the actuator body as follows:

- Double acting and spring to close models.

With the piston rack on the left side of the body bore, when viewed from the o-ring end of the piston, as shown (photo 2).

- Spring to open models.

With the piston rack on the right side of the body bore, when viewed from the o-ring end of the piston. Locate the assembly on the bench with one piston head on the bench and the other upwards. Push firmly on the top piston to cause both piston rack profiles to engage with the pinion teeth.

12. Position the assembly with the base plate on the bench. Using a suitable wrench, turn the pinion shaft clockwise (Double acting and Spring to close models), or counter-clockwise (Spring to open), as far as it will go. The keyways, at the top of the shaft, should be approximately 4 to 5 degrees clockwise, or counter-clockwise, past the axial and transverse centre lines of the body.
13. Smear the o-ring groove in each and cap with Molyrace LT2 lubricant. Fit the o-rings (24) into the grooves and position the actuator body with one end downwards on the bench.
14. Double acting models:

- Carefully locate one end cap (2) on the uppermost end of the body and secure using four hexagon head bolts and plain washers (16/17).

- Repeat for the other end cap.

Spring return models:

- Locate the correct number of springs (22) in the cavities on the piston head which is uppermost. (photo 3).
- Carefully locate one end cap over the springs so that the springs fit into the cavities in the end cap.
- Using the four hexagon head bolts and plain washers, compress the springs following the diagonal progression technique, until the end cap is fully tightened down against the end of the body.
- Repeat for the other end cap.

15. Locate the o-rings (29), into the recesses on the air connection plate and secure the plate to the actuator body using the two cap head bolts and spring washers (20/21). Ensure that the port marked "port 2" is to the right hand side as shown (photo 4).
16. Fit the lock nuts and sealing washers (14/15) to the travel stops and then screw the travel stops into the body.
17. For double acting versions, ensure that the pinion shaft is rotated fully clockwise and then screw in the right hand travel stop until the shaft keyways are in line with the major axes of the body and then tighten the lock nut to secure.
18. Turn the pinion shaft fully counter-clockwise and then screw in the left hand travel stop, until the shaft keyways are in line with the major axes of the body. Tighten the locknut to secure.

NOTE! For single acting versions, it is not advisable to use the travel stop screws to move the pinion as this may damage the cam faces or the stop screw ends.

19. For single acting versions, screw in the left hand travel stop to an estimated position and then apply pressure top open the actuator. Check the actual position of the pinion shaft, release the air pressure and reset the travel stop to compensate for any error. Repeat until the correct position is achieved. Tighten the lock nut to secure.
20. Apply pressure to open the actuator and screw in the right hand travel stop to an estimated position and then release the pressure. Check the actual position of the pinion shaft. Re-apply the pressure and reset the travel stop to compensate for any error. Repeat until the correct position is achieved.
21. Tighten the lock nut to secure.

Setting of internal travel stops

Premiair actuators are fitted with integral end of travel stops to enable setting of exact travel for the valve being operated.

These stops allow travel adjustment, as follows:

Over travel (at each end) of 5 +/- 5°

Under travel (at each end) of +/- 10°

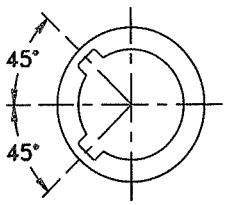
Increased under travel is available, on request.

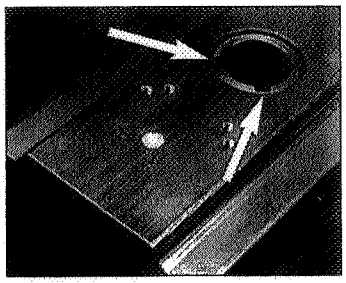
To set the stops (Double acting units)

1. Operate valve/actuator assembly to the closed position.
2. Remove air supply.
3. Slacken locknut on the close travel stop.
4. Turn the stop clockwise to reduce travel or anti-clockwise to increase travel.
5. Re-tighten locknut.
6. Reconnect air supply and check that the position is correct. If not repeatfrom instruction 2.
7. Apply air to operate the open position.
8. Remove air supply.
9. Adjust open travel stop screw as per instructions 3 to 6 above.

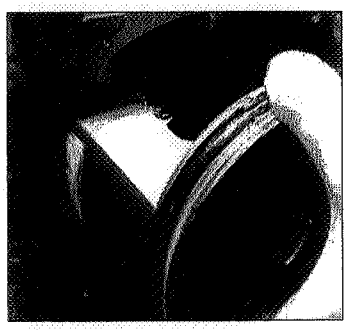
To set the stops (Single acting units) air fail close

1. Remove air supply so that actuator drives to closed position. Note actual position.
2. Apply air to open the actuator. Note actual position.
3. Whilst the air supply is maintained slacken the locknut on the close stop and adjust the stop screw by an amount estimated to give correct position. (Clockwise adjustment decreases travel).
4. Re-tighten locknut.

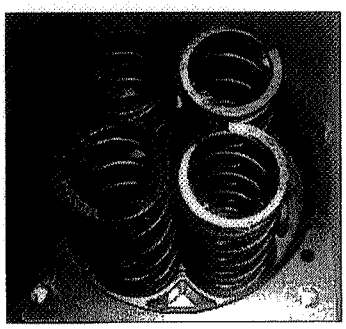




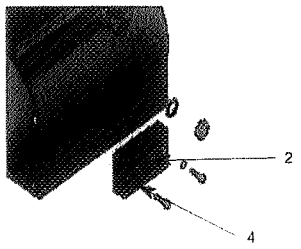
1. Position of keyways prior to fitting pistons



2. Fitting pistons into body



3. Locating of springs in piston head cavities



4. Fitting air connection plate

5. Remove air so that actuator closes. If correct closed position is not achieved repeat from instruction 2.
6. Slacken locknut on the open stop and adjust the travel by an amount estimated to give correct position. (Clockwise adjustment decreases travel).
7. Re-tighten locknut.
8. Apply air and check open position. If correct open position is not achieved, repeat from instruction 5.

To set the stops (Single acting units) Air fail open

1. Remove air supply so that actuator drives to open position. Note actual position.
2. Apply air to close the actuator. Note actual position.
3. Whilst the air supply is maintained slacken the locknut on the open stop and adjust the stop screw by an amount estimated to give correct position. (Clockwise adjustment decreases travel).
4. Re-tighten locknut.
5. Remove air so that actuator opens. If correct open position is not achieved repeat from instruction 2.
6. Slacken locknut on the close stop and adjust the travel by an amount estimated to give correct position. (Clockwise adjustment decreases travel).
7. Re-tighten locknut.
8. Apply air and check close position. If correct close positon is not achieved, repeat from instruction 5.

Maintenance

Provided that basic pneumatic system procedures are adhered to, the actuator will require little or no maintenance for many thousands of cycles.

Troubleshooting

If the actuator fails to operate the valve correctly, carry out the following checks.

1. Check that the air supply is at the required pressure.
2. Ensure that the air supply is not restricted in any way.

3. Check for air leakage on supply lines to the actuator.
4. Check for leakage at the top and bottom of the pinion shaft. Such leakage could be caused by a dirty air supply.
5. Check for leakage across the piston seals by applying pressure to "port 4" and looking for leakage from "port 2".
6. Check that the valve torque has not increased because of problems with the valve itself.

Note! Refer to dissasembly and assembly procedures for gaining access to o-rings and actuator internals if required.

General information

1. As standard, applying air to "port 2" will cause the actuator to rotate in a counter clockwise direction top open the valve.
2. Applying air to "port 4" will cause the actuator to rotate in a clockwise direction to close the valve (double acting versions only).
3. Warning: It is not recommended to "air assist" single acting actuators as this may apply excess load to the valve stem and cause damage.

Spring ratings versus air pressure

There is one size of spring per actuator for 'balance' against air pressures up to 80 psig (5,5 barg). Springs are used in multiples depending on the air pressure.The following table shows the springs needed to give balance at varying air pressures. 'Balance' means that air start tourque = spring start torque, and that air finish torque = spring finish torque.

Air pressure	Number of springs	
	Piston 1	Piston 2
40 psig/2,8 barg	2	2
50 psig/3,5 barg	3	2
60 psig/4,2 barg	3	3
70 psig/4,8 barg	4	3
80 psig/5,5 barg	4	4

For balance against higher pressures booster springs are fitted inside the standard springs of the 80 psig build as follows

Air pressure	Number of booster springs	
	Piston 1	Piston 2
90 psig/6,2 barg	2	2
100 psig/6,9 barg	4	4

Bolt tightening torques for end caps

When re-assembling the end caps, use the following figures for bolt tightening.

Actuator size	Bolt size	Tightening torque (Nm)
-002	M5	3,2
-004	M5	3,2
-009	M6	7,3
-014	M6	7,3
-025	M8	13,1
-037	M8	13,1
-045	M10	26,2
-070	M12	45,2
-088	M12	45,2
-180	M16	108,5

Hamworthy Moss AS

Part no: N8726-001txt

TG: Item: 153

Rev: 00

Date: 20080312

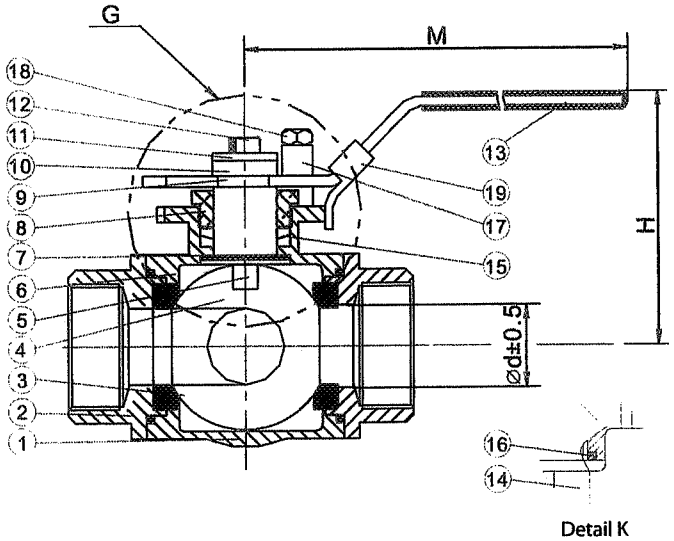
BALL VALVE

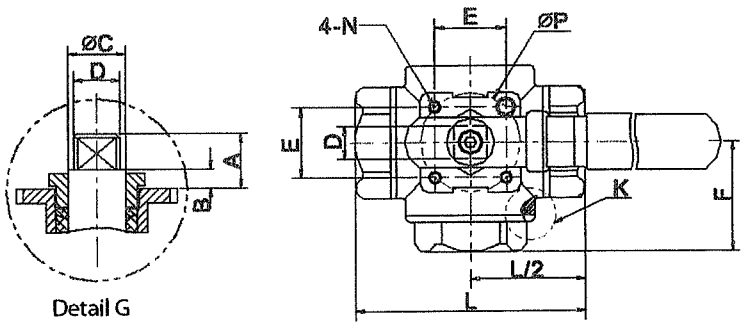
F138

Instruction

Features

- General purpose 1000 psi (PN63), ball valve
- Three way mulit-port ball valve with T-port, 90° operation
- Investment cast body
- Stainless Steel Body, RPTFE seats
- Screwed ends to BSPP, BSPT, NPT
- ISO 5211 top mounting plate
- Blow-out proof stem





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Hamworthy Moss AS

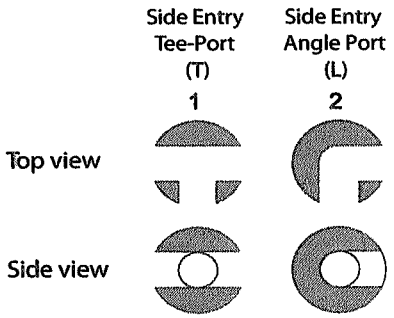
Part no: N8726-001txt Item:

Materials of construction			
No.	**Part Name**	**Material**	**Quantity**
1	Body	CF8M/1.4408	1
2	Cap	CF8M/1.4408	2
3	Seat	RPTFE	4
4	Ball	ASTM A351 Gr. CF8M	1
5	Anti-Static Stem	A276 Type 316	1
6	Joint Gasket	PTFE	2
7	Thrust Washer	PTFE	1
8	Gland	SUS304	1
9	Handle	SUS304	1
10	Handle Washer	SUS304	1-3
11	Washer	SUS304	1
12	Handle Nut	SUS304	1
13	Handle Sleeve	Vinyl	1
14	End Cap	CF8M/1.4408	1
15	Stem Packings	PTFE	1 Set
16	End Cap Seal	PTFE	1
17	Gland Washer	SUS304	1
18	Bolt	A2-70	1
19	Locking Device	SUS304	1

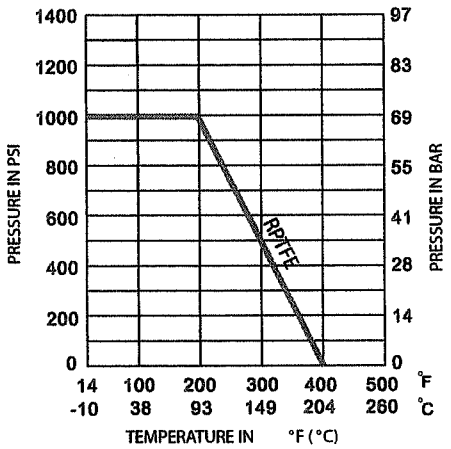
Dimensions (mm)														
Size	**DN**	**A**	**B**	**ØC**	**D**	**E**	**F**	**ØP**	**N**	**Ød ± 0.5**	**L ± 0.8**	**H ± 3.0**	**M ± 3.0**	**Wt (kg)**
1/4"	8	11	6	12	9	29.7	34.6	42	M5* 0.8	11	69	58	124	0,60
3/8"	10	11	6	12	9	29.7	34.6	42	M5* 0.8	11	69	58	124	0,60
1/2"	15	11	6	12	9	29.7	40.8	42	M5* 0.8	12.7	75	51	124	0.67
3/4"	20	13	6	15	11	35.4	45	50	M6* 1.0	16	86	71	168	1.20
1"	25	19	7.5	15	11	35.4	52.3	50	M6* 1.0	20	101	70	168	1.70
1 1/4"	32	19	7.5	15	11	35.4	58	50	M6* 1.0	25	118	88	198	2.40
1 1/2"	40	23.5	8.5	15	11	49.5	63	70	M8* 1.25	32	125	100	194	3.35
2"	50	24.5	8.5	18.5	14	49.5	75.5	70	M8* 1.25	38.1	149	110	215	5.50

Part no: N8726-001txt Item:

Ball port configuration



Pressure/Temperature chart



Hamworthy Moss AS

Part no: N8726-001 Item: 1153

Rev: 00

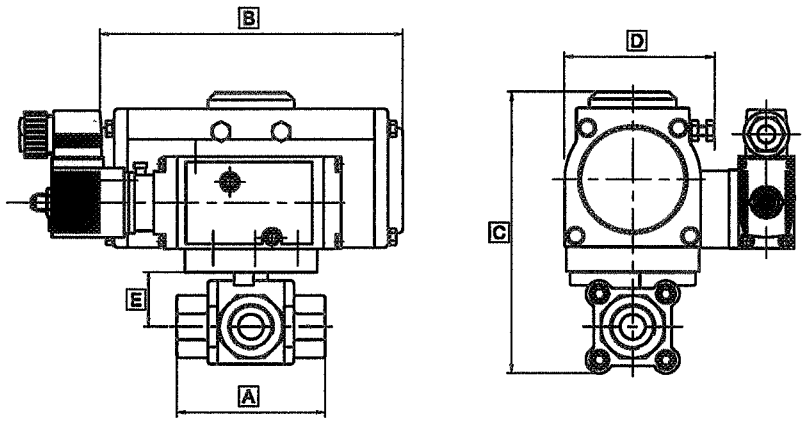
Date: 20080313

3-WAY BALL VALVE DN15

F138 FULL BORE 1/2" BSP

3-WAY BALL VALVE	ACTUATOR	SOLENOID VALVE	CONNECT
F138 FULL BORE	PRA-002	791/B 24V DC	1/2" BSP

A	B	C	D	E
75	155.8	190	71	41



Byggnr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date 20080313	Skala Scale ~	Gruppe nr. Group. No.	
Proj.metode Proj.method						MOSS INERT GAS SYSTEM	Erstn. for Replaces E3138-1	Erstattet av Replaced by	
Hamworthy Moss AS						Title: 3-WAY BALL VALVE ASSEMBLY DN15 - CONNECTION 1/2" BSP	N8726-001	Rev. 00	
							Side Sheet 1 av of 1 sider sheets	Format A4	

Forandringen: REV 00) 20080313/

Hamworthy Moss AS

Part no: N8658-001

Item: 24, 26

Rev: 01

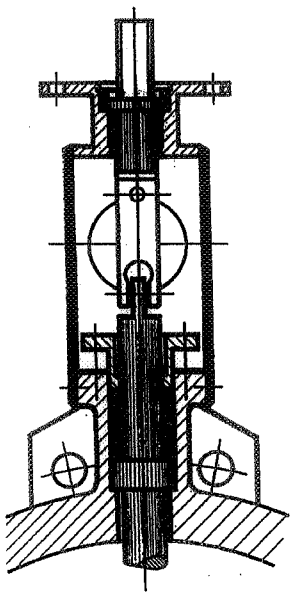
Date: 20071105

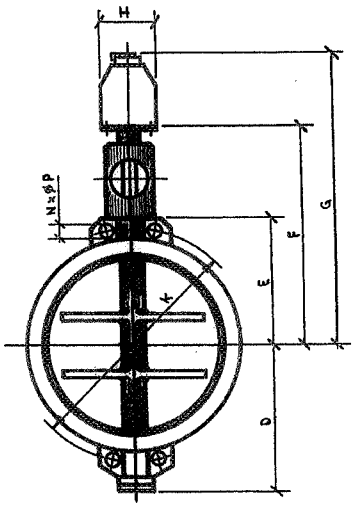
UPTAKE VALVE ASSEMBLY

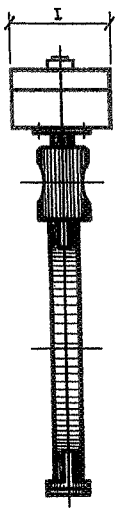
DN400 DIN PN10

DN400									
A	B	C	D	E	F	G	H	I	Weight
390	470	75	335	315	595	745	112	218	95

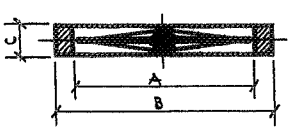
PN10									
K	240	295	350	400	460	515	565	620	925
N	8	8	12	12	16	16	20	20	20
P	23	23	23	23	23	28	28	28	31
Weight	46	54	63	74	85	95	110	116	141







BODY ASTM S3GT
DISC ASTM S3GT
SHAFT AISI 316 Ti
PACKING GRAPHITE



11-67

Part no: M3168-001txt Item: 24,26

Rev: 00 Date: 20080215

BUTTERFLY UPTAKE VALVE INSTRUCTION

INSTALLATION

Preparation

Before installation, clean the metal to metal butterfly valves, the gaskets and the pipe flanges carefully. Check that the flanges are aligned and parallel.

If there are any axial forces in the pipeline, such as thermal expansions, they must be compensated using expansion joints wherever it is necessary.

Shaft position and flow direction

This metal to metal butterfly valve is recommended to be installed in horizontal position because the self-cleaning action is ensured and because the weight of the valve disc is distributed over the bearings.

Taking this into consideration, the bottom haft of the disc is recommended to be opened against the direction of the flow, when opening the butterfly valve.

Mounting

This metal to metal butterfly valve must be centred in the flanges through the four centering-holes situated in the valve body neck.

Ensure that the disc can be turned through 90 degress without touching the pipe flanges. Then tighten the flange bolts in cross sequence, ensuring contact between the valve body, the gasket and the pipe flanges. Torque all bolts. The packing gland area must not be insulated.

Upon start up, the packing gland must be checked for tightness and retightness if it is necessary. Excessive tightness must be avoid, because this will increase the shaft friction and loss of elasticity of the packing.

MAINTENANCE

Inspection and retightening of the packings will become necessary after the metal to metal butterfly valves have been taken into operation. Excessive tightening of the packing gland must be avoid.

Retighten the flange bolts after a long operation time.

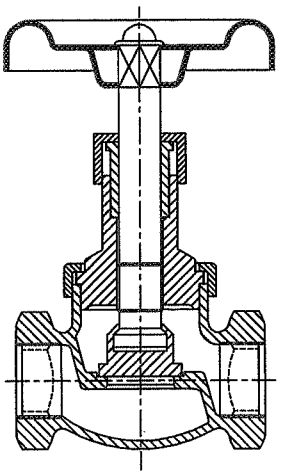
Hamworthy Moss AS

Part no: M0820-001

FG: Item: 30, 39

Rev: 01

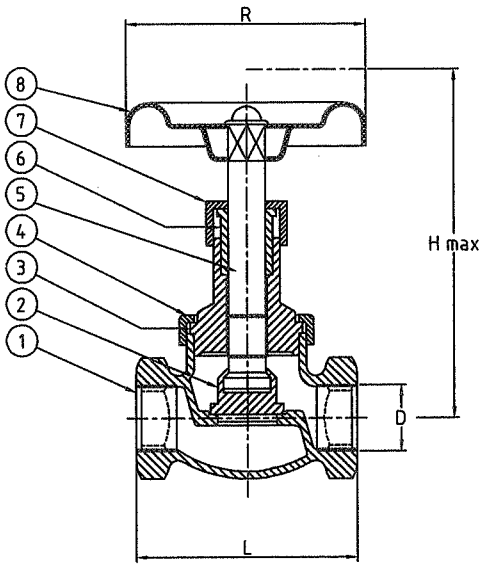
Date: 20050601



SHUT OFF VALVE

Non return

DN 25 - 1"



Application: Water, steam and oil

For warm sea water it is recommended to employ the execution with a stem of zincfree bronze CuSn8.

Variant: Non-return disc, parabolic disc etc.

Other materials on request.

DN	D	L	L_1	L_2	H max	H_1 max	R	Weight	Max. Working pressure		Test pressure	
									Mpa 100°C	Mpa 255°C	Open	Closed
25	G 1"	90	50	45	115	105	75	1,2	1,6	1,1	2,4	1,8

No	Part	Material
1	Body	Gunmetal LG2
2	Disc	Gunmetal LG2
3	Bonnet	Gunmetal LG2
4	Lock nut	Special brass

No	Part	Material
5	Stem	Special brass
6	Gland	Special brass
7	Gland nut	Special brass
8	Handwheel	Pressed steel

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Hamworthy Moss AS

Part no: M0827-001

FG: Item: 34

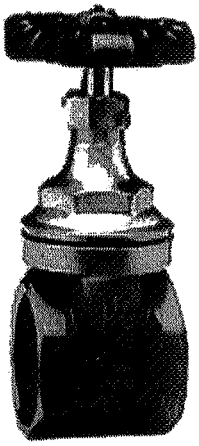
Rev: 01

Date: 20050601

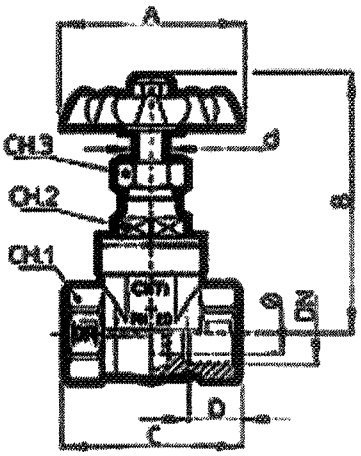
SHUT OFF VALVE

3/4" Brass

CIM 70/BS



DN	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Ø mm	13	19,4	26	32	38,5	50,4
Gram	295	445	615	925	1310	1895
A	55	60	65	75	80	90
B	80	97	108	121,5	142	165,5
C	54	59	66	74	75	86
D	15	16,3	19,1	21,4	21,4	25,7
CH1	27	32,5	40	49,5	55,5	68,5
CH2	22	24	26	32	42	52
CH3	19	21	21	25	25	29
d	8	8	9	10	11	12



Materials - Main Components

- Screwed bonnet, non rising stem, solid wedge disc
- Body, bonet, wedge: hot forged brass Cu Zn40 Pd2
- Stem and metal components: Machined from extruded brass bar Cu Zn40 Pb2
- Packing: AF/SK (free of asbestos), elastomers, syntetic resin and PTFE. It is suitable to a maximum temperature of 180°C (356°F)
- Gland packing: AF 15/MA heat resistant fibre, (free of abestos), elastomers, synthetic resin and PTFE. It is suitable to a maximum temperature of 250°C (482°F)
- Hand weel: Registered "CIM" model in gard duraluminium Al-Si 12, epoxy painted red RAL 3000, showing "on - off".
- Threading: Female parallel threads to BS 21 Rp - ISO 7/1°Rp; taper threads to BS 21 Rc - ISO 7/1°Rc; or American NPT threads ANSI B1.20.1 available on request
- Hydrostatic test pressures: Shell 30 bar (435 psi), Seat 22 bar (315 psi)
- Lockshield: Pattern available in sizes "1/2 to 2"
- Cold service: 20 bar at -10°C to 100°C
- Saturated steam: 9 bar at 180°C

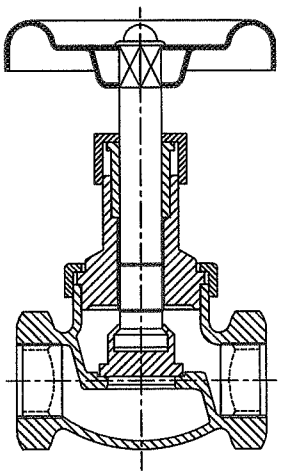
Hamworthy Moss AS

Part no: M0818-001

FG: Item: 86

Rev: 00

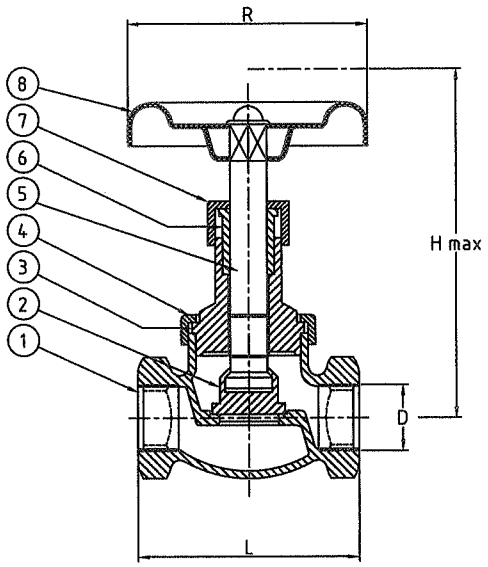
Date: 20070508



SHUT OFF VALVE

Non return

DN 15 - 1/2"



Application: Water, steam and oil

For warm sea water it is recommended to employ the execution with a stem of zincfree bronze CuSn8.

Variant: Non-return disc, parabolic disc etc.

Other materials on request.

DN	D	L	L_1	L_2	H max	$H_{1\ max}$	R	Weight	Max. Working pressure		Test pressure	
									Mpa 100°C	Mpa 255°C	Open	Closed
15	G 1/2"	65	40	35	95	86	65	0,5	1,6	1,1	2,4	1,8

No	Part	Material
1	Body	Gunmetal LG2
2	Disc	Gunmetal LG2
3	Bonnet	Gunmetal LG2
4	Lock nut	Special brass

No	Part	Material
5	Stem	Special brass
6	Gland	Special brass
7	Gland nut	Special brass
8	Handwheel	Pressed steel

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Hamworthy Moss AS

Part no: M0830-001

FG: Item: 40

Rev: 02

TG: 40

Date: 20050601

TEST COCK VALVE DN8

Connect: 1/4" BSP - Brass

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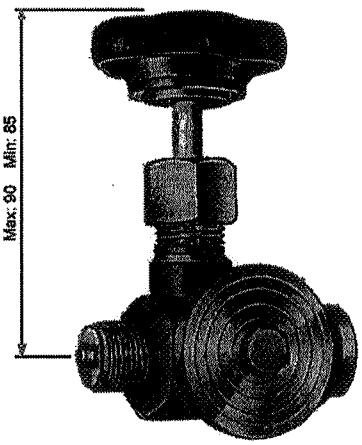
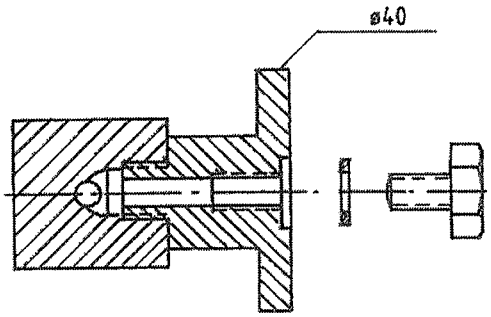
WEIGHT: 0,5kg





Forandringer: REV 00) 19991019/SKG REV 01) 20020516/Skg CONNECTION AND DIMENSION ADDED

Bygg nr. Yard No MOSS STANDARD	Ordre nr. Order No.	Tegn. Drawn Skg	Tracet Traced MLF	Kontr. Checked PCC	Godkj. App'd. MKN	Dato Date 19991019	Skala Scale ~	Gruppe nr. Group. No.
Proj.metode Proj.method	MOSS INERT GAS SYSTEM						Erstn. for Replacec	Erstattet av Replaced by
Hamworthy KSE a.s, Moss Liquid Cargo Handling	Title KONTROLLMANOMETERVENTIL TEST COCK						M2797-001std	Rev. 01
							Side Sheet 1 av of 1 sider sheets	Format A4

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Hamworthy Moss AS

Part no: M0832-001

TG: Item: 41, 42

Rev: 02

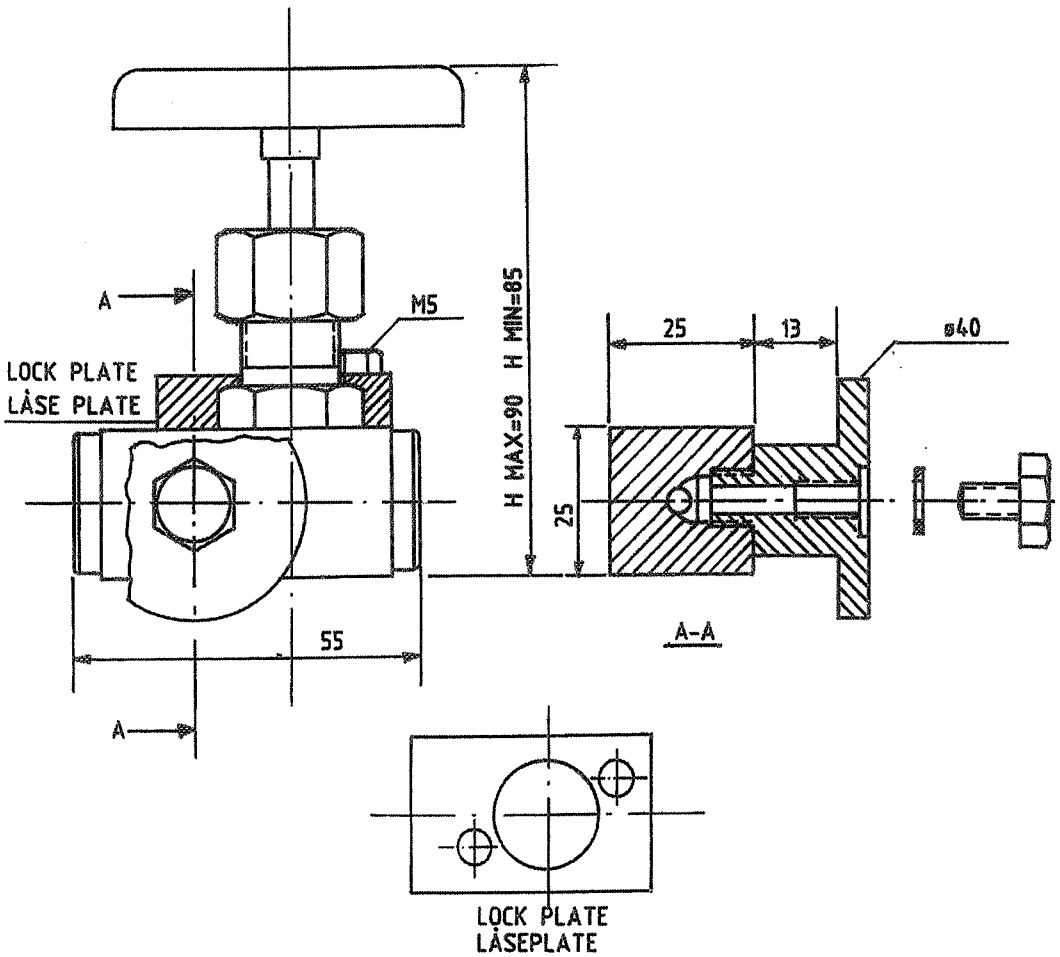
TG: 41

Date: 20050601

TEST COCK VALVE DN8

Connect: 1/4" BSP

AISI 316



11-73

Hamworthy Moss AS

Part no: M0062-001 Item: 64

Rev: 00

Date: 20070925

NON RETURN VALVE

DN400 DIN PN10

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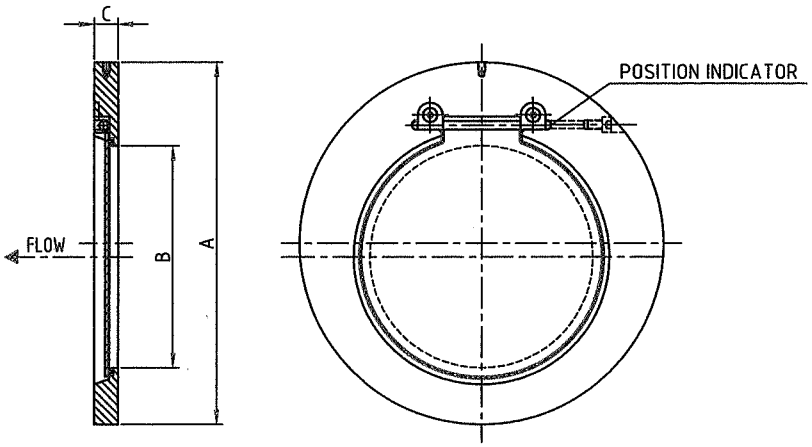

STANDARD : DIN/NS PN 10

NOM. DIA.	A	B	C	WEIGHT KG
400	489	310	32	30,0

MATERIALS :

BODY: COR-TEN

DISC: AISI 316L

Forandringer: REV 00) 20070925/

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
MOSS STANDARD			MLH			20070925	~	

Proj.metode / Proj.method

MOSS INERT GAS SYSTEM

Erstn. for Replacac: M3096-006std

Erstattet av Replaced by:

Hamworthy KSE a.s, Moss
Liquid Cargo Handling

Title: NON-RETURN VALVE

TYPE: SWING CHECK

M0062-001 Rev. 00

Side Sheet 1 av of 1 sider sheets

Format A4

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Hamworthy Moss AS

Part no: M0138-001 TG: Item: 66

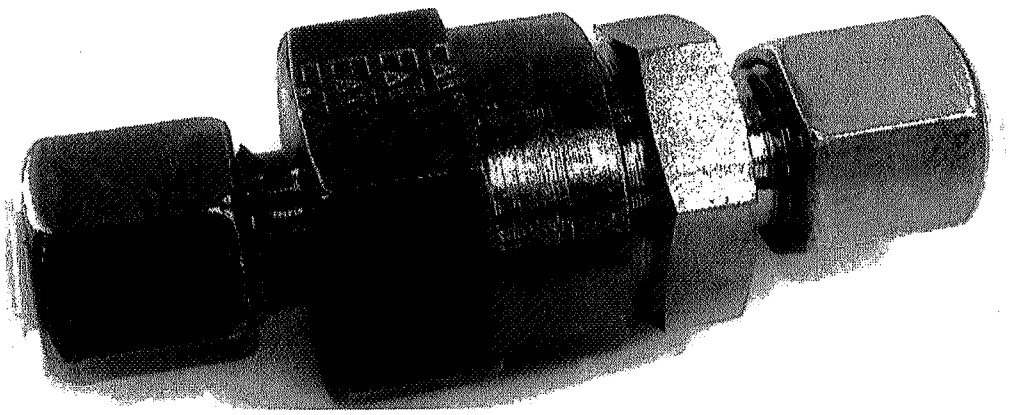
Rev: 02 Date: 20060109

NON RETURN VALVE

Connect: tube ø8 OD comp.ends

Non-return Valve

Material: steel
Supplied with 1 bar opening pressure as standard



Type	W.P. bar	L	Bore
RHD 8 L	400	67	6

Part no: M0044-001
TG: Item 69

NON RETURN VALVE

DN100

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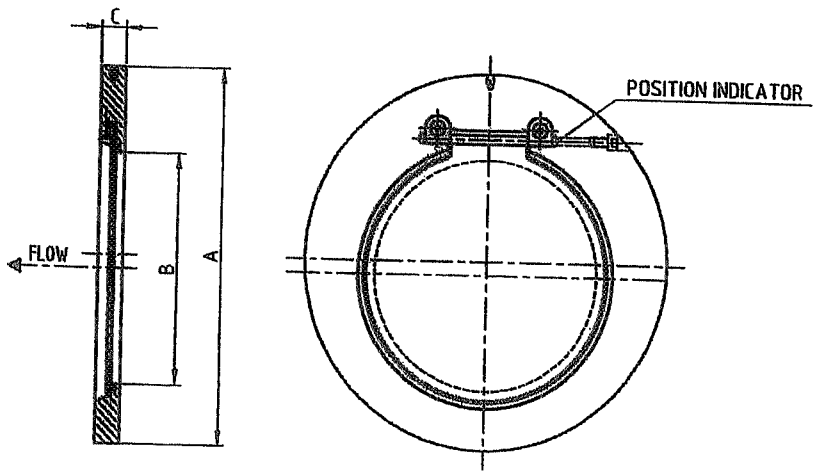

NOM. DIA.	A	B	C	WEIGHT KG
100	160	65	18	3,0

STANDARD: DIN/NS PN 10

MATERIALS:
BODDY: CorTen
DISC: AISI 316

Forandringen REV 00) 19991013/

Dreg nr. Tegn No: MOSS STANDARD	Ordre nr. Order No.	Tegn. Drawn: [signature]	Trace Traced: MLF	Kontr. Checked: SS	Godkj. Appd: [signature]	Date Date: 19991013	Skala Scale: ~
Gruppe nr. Group. No.							
Proj.metode Proj.method	MOSS INERT GAS SYSTEM					Erstn. for Replaces: 40784307	Erstattet av Replaced by
Hamworthy KSE a.s, Moss Liquid Cargo Handling	Title: NON-RETURN VALVE TYPE: SWING CHECK					M3096-007std	Rev. 00
						Side Sheet 1 av of 1 sider sheets	Format A4

Hamworthy

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Hamworthy Moss AS

Part no: M0149-001 TG's Item: 81

Rev: 01 Date: 20050105

FUEL OIL FILTER

DN25 2.04.5

Flange: DIN PN16

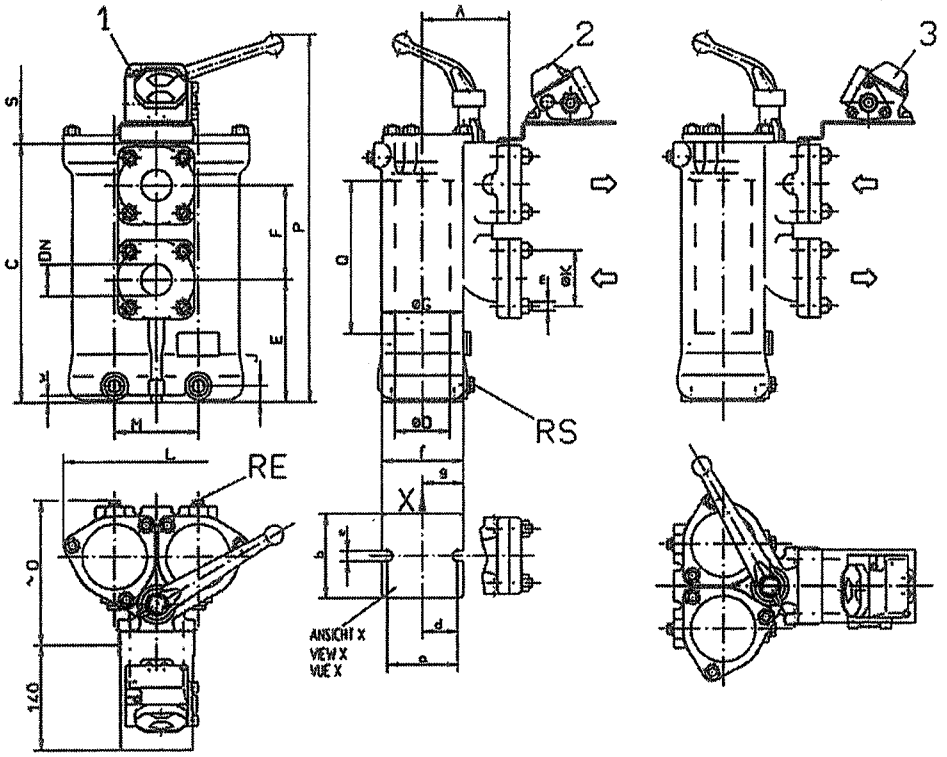
MANUAL

FUEL OIL FILTER

11-77

Hamworthy Moss AS

Part no: M0149-001 Item:



RE ENTLUEFTUNG G1/4"
AIR ESCAPE G1/4"
DÉSAÉRATION G1/4"

RS ENTLEERUNG G3/8"
DRAIN G3/8"
VIDANGE G3/8"

AUF WUNSCH, ON REQUEST, SUR DEMANDE

1 DIFFERENZDRUCKANZEIGER (DDA)
DIFFERENCE PRESSURE INDICATOR
INDICATEUR DE DIFFÉRENCE DE PRESSION

2 DDA-ANBAU FUER STERNSIEBE
DDA-INSTALLATION FOR STAR-ELEMENT
DDA-ASSEMBLAGE POUR PANIERS À ETOILE

3 DDA-ANBAU FUER KORBSIEBE
DDA-INSTALLATION FOR BASKET-ELEMENT
DDA-ASSEMBLAGE POUR PANIERS À CORBEILLE

S SIEBAUSBAU
FOR DISMOUNTING THE FILTER ELEMENT
DÉMONTAGE DU PANIER

GEHAEUSE GEGOSSEN
CASTED CASING
CORPS MOULÉ

BETRIEBSUEBERDRUCK
WORKING PRESSURE
PRESSION DE SERVICE

GEHAEUSE AUS GG25
16BAR BEI 200°C
CASING OF GG25
16BAR AT 200°C
CORPS EN GG25
16BAR À 200°C

GEHAEUSE AUS GGG40
25BAR BEI 120°C
CASING OF GGG40
25BAR AT 120°C
CORPS EN GGG40
25BAR À 120°C

FLANSCHANSCHLUSS
FLANGED JOINT
RACCORD À BRIDES

STIFTSCHRAUBE DIN939
STUD BOLT DIN939
BOULON DIN939

DN	K	m	
25	80	M10	M10 X 25
32	80	M10	M10 X 25

SECHSKANTSCHRAUBE DIN931
SPANNER BOLT DIN931
VIS HEXAGONALE DIN931

DN	K	a	
40	100	ø14	M12 X 50
50	110	ø14	M12 X 50
65	130	ø18	M16 X 50
80	150	ø18	M16 X 50

BESTELLBEISPIEL
ORDERING EXAMPLE
EXEMPLE DE COMMANDE

TYP	øG	Q	DN
2.04.5	90	145	32

ALLGEMEINTOLERANZEN DIN 7168-sg
TOLERANCE DIN 7168-sg
TOLERANCE DIN 7168-sg

øG	Q	DN MIN.	DN MAX.	A	C	øD	E	F	J	L	M	~O	P	S	a	b	d	e	f	g	w	VOL. dm³	KG
90	95	25	32	95	199	65	79	80	22	206	92	159	363	170	95	92		12	110		10	2X1	17
90	145	32	40	95	249	65	129	80	22	206	92	159	413	220	95	92		12	110		10	2X1	18
110	210	40	50	115	330	85	157	120	20	250	110	189	478	300	95	110		14	110		10	2X2	29
110	260	50	65	128	385	85	208	120	20	230	110	202	533	350	95	110		14	110		10	2X3	36
110	390	65	80	180	523	85	317	140	34	260	120	244	685	480	120	65	75	14	200	137	20	2X4	55
170	500	80	100	214	690	124	453	160	50	370	203	307	835	700	174	120	105	18	220	135	25	2X13	107

SUBJECT TO ALTERATIONS AENDERUNGEN VORBEHALTEN! MODIFICATIONS RÉSERVÉES

DUPLEX FILTER DOPPELFILTER 2.04.5 FILTRE DOUBLE

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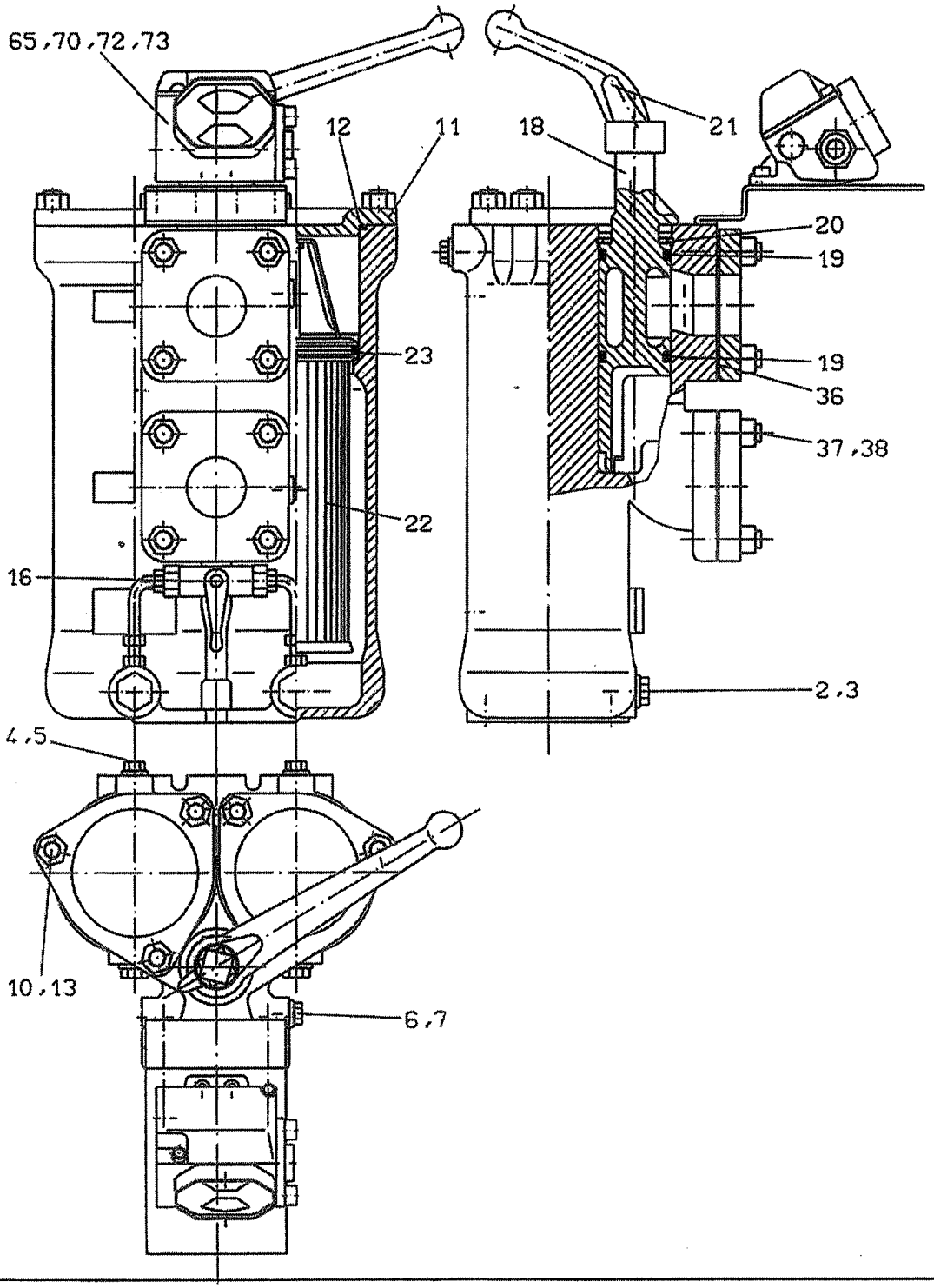
Hamworthy Moss AS

Part no: M0149-001 Item:



SPARE PART LIST

ERSATZTEILLISTE
TYP 2.04.5 DN25-50

LISTE DES PIECES DE RECHANGE

11-79

ERSATZTEILLISTE TYP 2.04.5

SPARE PART LIST | **LISTE DES PIECES DE RECHANGE**

Typenschlüssel:
2.04.5. =Doppelfilter — *duplex filter* — *Filtre double*
G . =Gehäusedurchmesser — *cabin diameter* — *diamètre du corps*
Q . = Filtereinsatzlänge — *length of the filter element* — *longueur du panier*
DN .= Anschlußflansche — *connection flanges* — *brides désirées*

Pos. Nr.	Bezeichnung Designation Designation	DN 25	St.	DN 32	St.	DN 40	St.	DN 50	St.	DN 65	St.	DN 80	St.
2	Verschlußschraube screw plug vis	DIN 910 G 3/8	2	DIN 910 G 3/8	2	DIN 910 G 3/8	2	DIN 910 G 3/8	2	DIN 910 G 3/8	2.	DIN 910 G 3/8	2
3	Dichtung gasket joint	DIN 7603 A 17x21x1,5	2	DIN 7603 A 17x21x1,5	2	DIN 7603 A 17x21x1,5	2	DIN 7603 A 17x21x1,5	2	DIN 7603 A 17x21x1,5	2	DIN 7603 A 17x21x1,5	2
4	Verschlußschraube screw plug vis	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2
5	Dichtung gasket joint	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2
6	Verschlußschraube screw plug vis	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2	DIN 910 EG ¼	2
7	Dichtung gasket joint	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2	DIN 7603 A 14x18x1,5	2
10	Stiftschraube bolt vis	DIN 939 M 10x25	6	DIN 939 M 10x25	6	DIN 939 M 12x30	6	DIN 939 M 12x30	6	DIN 939 M 12x30	6	DIN 939 M 16x35	6

Hamworthy Moss AS
Part no: M0149-001
Item:

Pos. Nr.	Bezeichnung Designation Designation	DN 25	St.	DN 32	St.	DN 40	St.	DN 50	St.	DN 65	St.	DN 80	St.
11	Deckel cover couvercle	Z26002	2	Z26002	2	Z25721	2	Z25721	2	Z25721	2	Z31610	2
12	O-Ring gasket joint	2-232	2	2-232	2	2-238	2	2-238	2	2-238	2	2-254	2
13	Mutter nut ecrou	DIN 934 M 10	6	DIN 934 M 10	6	DIN 934 M 12	6	DIN 934 M 12	6	DIN 934 M 12	6	DIN 934 M 16	8
16	Kugelhahn ball valve vannes à boisseau spherique	-----		-----		-----		-----		G 3/8	1	G 3/8	1
18	Küken cock vanne à boisseau	Z25998	1	Z25998	1	Z25889	1	Z25735	1	Z31309	1	Z31612	1
19	O-Ring gasket joint	2-220	2	2-220	2	2-326	2	2-329	2	2-335	2	2-341	2
19.1	O-Ring gasket joint	-----		-----		-----		-----		2-334	1	2-339	1
20	Sicherungsring circlip ring circlip exterieune	DIN 472 42x2	1	DIN 472 42x2	1	DIN 472 50x2,5	1	DIN 472 60x3	1	DIN 471 78x2,5	1	DIN 471 78x2,5	1
21	Hahnschlüssel plug key clef du robinet	WN 48.2	1	WN 48.2	1	WN 48.2	1	WN 48.2	1	WN 48.2	1	WN 48.2	1
22	Siebeinsatz siebe element élément filtrant	nach Auftrag		to order		d'apres commande		nach Auftrag		to order		d'apres commande	

Hamworthy Moss AS

Part no: M0149-001

Item:

Pos. Nr.	Bezeichnung Designation Designation	DN 25	St.	DN 32	St.	DN 40	St.	DN 50	St.	DN 65	St.	DN 80	St.
23	Quad-Ring gasket joint	4330	2	4330	2	4336	2	4336	2	-------		------	
36	Dichtung gasket joint	50x67x1,5	2	50x67x1,5	2	62x84x1,5	2	78x94x1,5	2	90x110x1,5	2	116x130x1,5	2
37	Schraube bolt vis	DIN 939 M10x25	8	DIN 939 M10x25	8	DIN 931 M12x50	8	DIN 931 M12x50	8	DIN 931 M16x50	8	DIN 931 M16x50	8
38	Mutter nut ecrou	DIN 934 M 10	8	DIN 934 M 10	8	DIN 934 M 12	8	DIN 934 M 12	8	DIN 934 M 16	8	DIN 934 M 16	8
65	DDA DPI IPD	nach Auftrag		to order		d'apres commande		nach Auftrag		to order		d'apres commande	
70	Zylinderschraube screw vis	DIN 912 M6x16	2	DIN 912 M6x16	2	DIN 912 M6x16	2	DIN 912 M6x16	2	DIN 912 M6x16	2	DIN 912 M6x16	2
72	Mutter nut ecrou	DIN 934 M 6	2	DIN 934 M 6	2	DIN 934 M 6	2	DIN 934 M 6	2	DIN 934 M 6	2	DIN 934 M 6	2
73	Federring spring washer annneau ressant	DIN 127 A 6	2	DIN 127 A 6	2	DIN 127 A 6	2	DIN 127 A 6	2	DIN 127 A 6	2	DIN 127 A 6	2

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Hamworthy Moss AS

Part no: M0149-001

Item:

Installation and Operating Instructions

General:

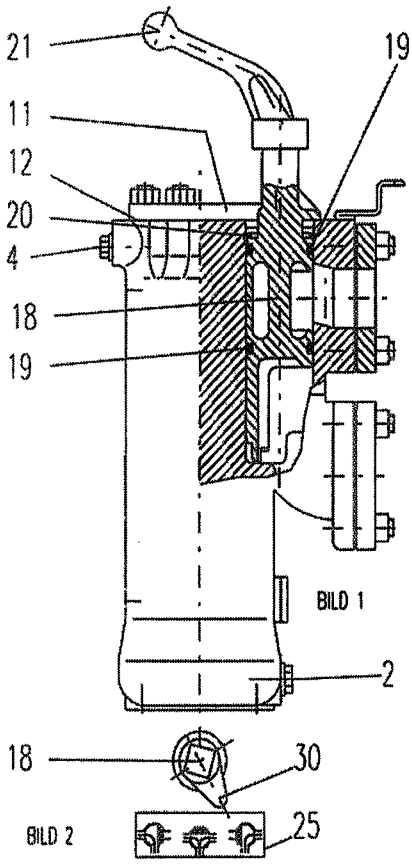

BILD 1

BILD 2

The switchable-duplex filter type 2.04.5 comprises two filter housings which are connected in parallel through a two-stage change-over housing. The filter housings are designed to meet current regulations in respect of pressure rating. The filter elements are adequately protected to cope with the differential pressures which occur in the filter, details of which are given on the filter mounted instruction plates. These pressures are 1,2 bar for star-form elements and 0,8 bar for basket-type elements.

Duplex filters are installed in cases where regeneration of contaminated filter elements must be carried out without shutting down the equipment or plant.The change-over housing, which contains a segment-type rotating valve, allows shock pressure-free change over, because as one chamber is closed theother chamber is opened the same amount, in otherwords, both filter chambers can be put into operation at the same time whenever the need arises (see Picture 2 - Valve Position Indicator). The undesired closing of both chambers is prevented by a stop, i.e.by the constructional design of the change-over housing.

Installation:

The filter housings must not be over-stressed when tightening the filter assembly onto its base or mounting. This also applies to the pipe connections. It is also important to make sure that the direction of liquid flow through the filter is compatible with the filter elements installed in the filter. The flow direction is marked on the filter assembly, usually on the flanges.

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According to the AD Information Sheets, the filter housings are only rated for internal overpressure. Additional external forces and moments at the connection flanges of the filter are to be avoided (possibly support feed lines).

I. Segment Valve Operation

The segment valve (18) is operated by the lever (21). The lever moves through an angle of 144ø. The travel stops of the lever are located inside the change-over housing. A cam, which is cast integral with the neck of the segment valve extension, moves over the valve position indicator plate (25) to indicate to the operator the position of the segment valve (see Picture 2).

1. Changing over filter chambers:

1.1 Slacken the air vent plug (4) of the cleaned filter chamber.

1.2 Turn the lever (21) to move the position indicator cam from position "1" to position "2" (see Picture 2). In this position the segment valve opens a port to allow liquid to flow in and fill the cleaned chamber. As soon as the liquid flows free of air bubbles from the vent plugt (4), close the vent plug.

2. Preparing the Filter for Operation

2.1 Position the lever (21) in the middle position - both filter chambers in operation.

2.2 Open both filter chamber vent plugs.

2.3 Start and slowly run the plant or equipment.

2.4 As soon as liquid flows from the vent plugs free of air bubbles, close the vent plugs.

2.5 Operate the lever to close one of the filter chambers; whilst the other filter chamber takes over filtration of the liquid, the other (closed) filter chamber remains in reserve until, due to contamination, the maximum preset differential pressure is reached. At a differential pressure of 1,2 bar allowed for starform elements or 0,8 bar allowed for basket-type elements, the reserve or cleaned filter chamber is to be put into operation as follows:

2.6 Momentarily open the vent plug (4) of the reserve chamber and check to make sure that this chamber is full.

2.7 Change over the filters as described under paragraph 1.

2.8 Open the vent plug (4) of the closed filter chamber to relieve any pressure in this chamber. It will now be possible to check whether the segment-valve (18) has in fact closed the inlet port to this chamber.
Note that a complete sealing of a segment type valve is not possible. By opening the sludge discharge plug (2), any liquid that has leaked passed the segment valve during cleaning can be drained off.

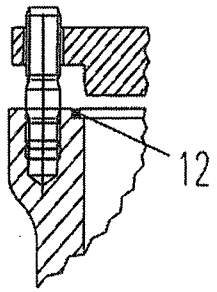
2.9 Remove the filter cover (11) from the closed (shutoff) filter chamber.

2.10 Open the sludge discharge plug (2) and drain down the liquid until the liquid level is below the seat of the element. Remove the filter element from the filter housing.

2.11 Clean the filter element (see the Operating Instructions for cleaning the element).

2.12 Replace the cleaned element into the filter housing. Make sure the seal of the element is not damaged before replacing the element!

2.13 Replace the filter cover (11). The vent plug is to be left open at this stage. Make sure that the cover seal (12) and its seat are clean and in a good condition, if necessary, renew the seal (12).



Z31646/FOLIE V. 07.08.96

It is recommended to wet the recess for the O-ring (12) in the Filter housing with Vaseline to make it more difficult for the O-ring to move..

2.14 Move the lever (21) from position "1" to position "2" - the cleaned filter chamber will now be refilled and vented of air.

2.15 Close the vent plug - the filter chamber is now in an operational-ready condition.

3. Maintenance

Maintenance of the duplex filter extends to an inspection and eventual replacement of the sealing elements and screens. If the filter assembly shows signs of corrosion, then it should be reconditioned or renewed as necessary.
The filtering of cooling water and other certain types of operating mediums can lead to formation of harmful deposits on the surfaces of the components in the change-over housing, it is therefore advisable to operate the change-over mechanism at regular inter vals to avoid seizure of the segment valve.

Removing and Replacing the Segment valve (18)

3.1 Open both filter chamber vent plugs (4) to depressurize the filter chambers.

3.2 Drain both filter chambers.

3.3 Using circlip pliers (DIN 5256C - Securing Borings), remove the circlip (20) from the groove.

3.4 By rotating and at the same time lifting the segment valve (18), remove the valve from the change-over housing.

3.5 Detach the O-rings (19).

3.6 Thoroughly clean the segment valve and examine the valve for damage. Remove any traces of scoring by polishing the valve with a suitable, fine carborumdum paste. Examine the valve bore in the change-over housing and if necessary treat in the same manner.

3.7 Lightly oil the O-rings (19) and then refit them in the grooves of the segment valve. It is recommended to renew these O-rings as, due to hardening and compression they loose a certain amount of elasticity.

3.8 Carefully insert the segment valve (18) into the top of the change-over housing and, by pressing down and rotating the valve at the same time, push the valve into the housing.

3.9 Position the indicator cam to point to the centre position on the valve position indicator plate (see Picture 2).

3.10 Now push the segment valve further down into the bore until the groove for the circlip (20) becomes visible.

3.11 Refit the circlip (29) in the groove.

3.12 Check the segment valve for ease of operation.

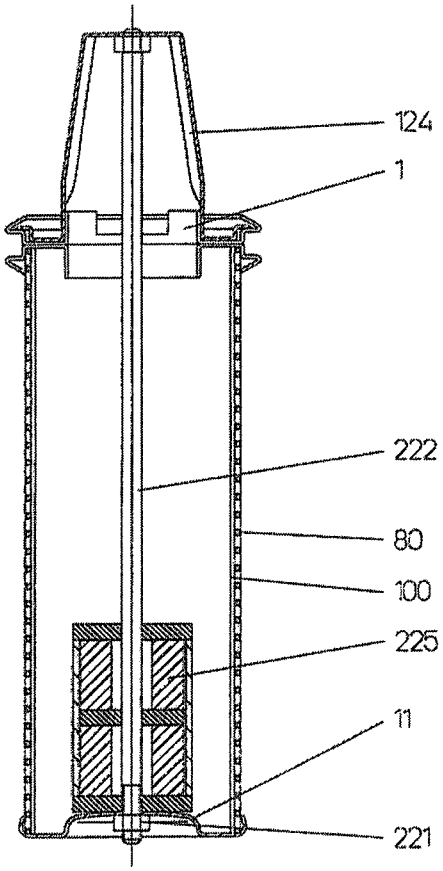
3.13 Prepare the filter assembly for operation as described in paragraph 2.

1. Maintenance and Cleaning

1.1 Take the filter out of operation. See the operating instructions for simplex and duplex filters.

1.2 The filter chamber taken out of operation is drained, using the discharge screw, until the level of the liquid is below the element support. The basket element is then removed from the housing. The coarsest dirt particles can now be shaken off. The element should then be placed in a suitable cleaning agent, e.g. BOLL CLEAN 2000, and compressed air should carefully be blown through the element from the outside to the inside. For obstinate dirt, use of a soft brush which will not damage the mesh is recommended.

If media containing ferritec particles are to be filtered out, the basket element is fitted with a bar magnet (225).



1.3 **Structure of the Basket Element**
The basket element is a compound structure, consisting of a bottom plate (11), top ring (1), handle (124), support mantle (80) and tie rod (222).

All the elements are held together on the tie rod (222). The thread on the tie rod (222) is glued to the handle (124) so that the element can only be dismantled by undoing the hexagonal nut (221).
The wire gauze (100) is wleded from inside on to the support mantle (8).
The flow is always from the inside to the outside.

1.4 **Basket element**
The element is to be inspected and cleaned at regular intervals. The length of the intervals depends on the amount of contamination expected. It is recommended, however, that the initial cleaning should take place immediately after a new system is flushed trough.
In general, however, the pressure drop across the filter is a good indicator of the contamination on the filter element. This pressure drop should not exceed 0,8 bar, since otherwise there is a danger of the element fracturing.
(Dedicated differential-pressure monitors are available from the BOLL & KIRCH product range.)

FG: Item 103,104

ABB Electrical Machines LV Motors	Technical Data Sheet			ABB
	Project		Location	
Department/Author	Customer name		Customer ref.	Item name
Ø. Berg	Flebu / Hamworthy		130959	1,001
Our ref.	Rev/Changed by	Date of issue	Saving ident	Pages
ØB	A	23.11.2006	untitled.xls	1(3)

No.	Definition	Data	Unit	Remarks	
1	Product	*TEFC, 3-phase, squirrel cage induction motor*			
2	Product code	*3GBP 221 002-ADA*			
3	Type/Frame	*M3BP 225 SMC 2*			
4	Mounting	*IM1001, B3(foot)*			
5	Rated output P_N	*65*	kW		
6	Service factor	*1*			
7	Type of duty	*S1(IEC) 100%*			
8	Rated voltage U_N	*440*	VD	± 5 % (IEC 60034-1)	
9	Rated frequency f_N	*60*	Hz	± 2 % (IEC 60034-1)	
10	Rated speed n_N	*3550*	r/min		
11	Rated current I_N	*103*	A		
12	No-load current	*19,9*	A		
13	Starting current I_s/I_N	*6,6*			
14	Nominal torque T_N	*175*	Nm		
15	Locked rotor torque T_S/T_N	*2,3*			
16	Maximum torque T_{max}/T_N	*2,6*			
17	Minimum torque T_{min}/T_N	*1,7*			
18	Speed at minimum torque	*720*	r/min		
	Load characteristics (IEC 60034-2)	Load %	Current A	Efficiency %	Power factor
19		*100*	103	94,5	0,9
20		*75*	76	94,7	0,89
21		*50*	54	93,7	0,85
22		*Start*	680		0,36
23	Maximum starting time from hot	*15*	s		
24	Maximum starting time from cold	*27*	s		
25	Insulation class / Temperature class	*F / B*			
26	Ambient temperature	*45*	°C	*Marin, DNV*	
27	Altitude	*1000*	m.a.s.l.		
28	Enclosure	*IP55*			
29	Cooling system	*IC411 self ventilated*			
30	Bearing DE/NDE	*6313/C3 - 6312/C3*			
31	Type of Grease				
32	Sound pressure level (LP dB(A) 1m)		dB(A)	at load	
33	Moment of inertia J = ¼ GD2	*0,29*	kg-m2		
34	Balancing				
35	Vibration class				
36	Position of terminal box	*Top*			
37	Terminal box entries; no, dimens.				
38	Number of power terminals				
39	Direction of rotation.	*CW or CCW*			
40	Weight of rotor	*78*	kg		
41	Total weight of motor	*355*	kg		
42	Dimension drawing no.				
43					
44					
45					
Ex-motors					
46					
47					

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EL. MOTOR

1. General

NOTE!
These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of anyone who installs, operates or maintains this equipment. Ignoring the instruction may invalidate the warranty.

1.1 Declaration of Conformity

Declarations of Conformity with respect to the Low voltage Directive 73/23/EEC amended by Directive 93/68 EEC are issued separately with individual machines.
The Declaration of Conformity also satisfies the requirements of a Declaration of Incorporation with respect to the Machinery Directive 98/37/EEC, Art 4.2 Annex II, sub B

1.2 Validity

The instructions are valid for the following ABB electrical machine types, in both motor and generator operation.

series MT*, MBT*, MXMA,
series M2A*/M3A*, M2B*/M3B*, M2C*/M3C*, M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*, M2V*/M3V*

in frame sizes 56 - 450.

There is a separate manual for e.g. Ex motors 'Low voltage motors for hazardous areas: Installation, operation and maintenance Manual' (Low Voltage Motors/Manual for Ex-motors).

Additional information is required for some machine types due to special application and/or design considerations. Additional information is available for the following motors:

- roller table motors
- water-cooled motors
- open drip proof motors
- smoke venting motors
- brake motors
- permanent magnet motors

2. Installation

2.1 Putting into service (starting)

2.1.1 Reception check

Immediately upon receipt check the machine for external damage and if found, inform the forwarding agent without delay.

Check all rating plate data, especially voltage and winding connection (star or delta). The type of bearing is specified on the rating plate of all motors except the smallest frame sizes.

Remove transport locking if employed.Turn shaft by hand to check free rotation.

Do not exceed permissible loading values of bearings stated in the product catalogue.

Motors equipped with roller bearings: Running the motor with no radial force applied to the shaft may damage the roller bearing.

Motors equipped with angular contact bearing: Running the motor with no axial force applied in the right direction to the shaft may damage the angular contact bearing.

Motors equipped with regreasing nipples:
When starting the motor for the first time, or after long storage of the motor, apply the specified quantity of grease until grease is forced out of the grease outlet.

For details see section "Manual lubrication" on page 9.

2.1.2 Insulation resistance check

Measure insulation resistance before commissioning and when winding dampness is suspected.

Resistance, measured at 25°C, shall exceed the reference value, i.e. 10 M ohm (measured with 500 V dc Megger)

WARNING
Windings should be discharged immediately after measurement to avoid risk of electric shock.

Insulation resistance reference value is halved for each 20°C rise in ambient temperature.

If the reference resistance value is not attained, the winding is too damp and must be oven dried.
Oven temperature should be 90°C for 12-16 hours followed by 105°C for 6-8 hours.

Drain hole plugs, if fitted, must be removed and closing valve, if fitted, must be opened during heating.

Windings drenched in seawater normally need to be rewound.

2.1.3 Direct-on-line or star/delta starting

The terminal box on standard single speed machines normally contains 6 winding terminals and at least one earth terminal.

Earthing must be carried out according to local regulations before the machine is connected to the supply voltage.

The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL):
Y or D winding connections may be used.

e.g. 660 VY, 380 VD indicates Y-connection for 660 V and D-connection for 380 V.

Star/Delta starting (Y/D):
The supply voltage must be equal to the rated voltage of the machine in D-connection.

Remove all connection links from the terminal block.

For two-speed, single phase and special machines, supply connection must follow the instructions inside the terminal box.

If direct-on-line starting lasts for more than 10 seconds or Y/D starting more than 30 seconds, consult ABB Sales Office or see the publication 'The Motor Guide' (also available on the internet on www.abb.com/motors&drives).

2.1.4 Terminals and direction of rotation

Direction of rotation is clockwise when viewing the shaft face at the machine drive end, when the line phase sequence L1, L2, L3 is connected to the terminals as shown in the figure 1.

To alter the direction of rotation, interchange the connection of any two line cables.

If the machine has a uni-directional fan, ensure that the direction of rotation is according to the arrow marked on the machine.

2.2 Handling

2.2.1 Storage

The machine should always be stored indoors, in dry, vibration free and dust free conditions.

Unprotected machined surfaces (shaft-ends and flanges) should be protected with anti-corrosive treatment.

It is recommended that shafts be rotated periodically by hand to prevent grease migration.

Anti condensation heaters, if fitted, should preferably be energised.

The characteristics of electrolytic capacitors, if fitted to single-phase motors, will require "reforming" following periods of storage exceeding 1-2 years.
Contact ABB Sales Office for details.

2.2.2 Transportation

Machines fitted with cylindrical-roller and/or angular contact bearings must be fitted with locking devices during transport.

2.2.3 Lifting

Lift the motor using the lifting lugs only, if not otherwise stated in the separate lifting instruction.

The center of gravity of motors with the same frame may vary due to different outputs, mounting arrangements and auxiliary equipment.

Check that eyebolts or the lifting lugs integrated with the motor frame are undamaged before lifting. Damaged lifting lugs must not be used.

Lifting eyebolts must be tightened before lifting.
If needed the position of the eyebolt must be adjusted with suitable washers.

Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.

Care must be taken not to damage auxiliary equipment and cables attached to the motor.

2.2.4 Machine weights

Total machine weight can vary within the same frame size (center height) depending on different output, mounting arrangements and added features.

The following table shows estimated maximum weights for machines in their basic versions as a function of frame material.

The actual weight of all our motors is stated on the rating plate except the smallest frame sizes.

	Aluminum		Cast iron	Steel
Frame size	Weight kg	Add. for brake	Weight kg	Weight kg
56	4.5	-	-	-
63	6	-	-	-
71	8	5	13	-
80	12	8	20	-
90	17	10	30	-
100	25	16	40	-
112	36	20	50	-
132	63	30	90	-
160	110	30	175	-
180	160	45	250	-
200	220	55	310	-
225	295	75	400	-
250	370	75	550	-
280	405	-	800	600
315	-	-	1700	1000
355	-	-	2700	2200
400	-	-	3500	3000
450	-	-	5000	4500

Table 1

2.3 Installation

2.3.1 Cooling

Normal ambient temperatures should not exceed 40°C (marine standard +45 or +50°C) if standard performance is to be achieved. Check that the motor has sufficient airflow. Ensure that no nearby equipment, surfaces or direct sunshine, radiate additional heat to the motor. For more information about higher ambient temperatures and cooling, see "the Motor Guide" or contact ABB Sales Office.

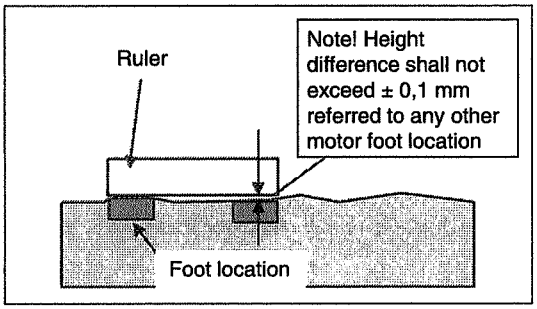
2.3.2 Foundation

The purchaser bears full responsibility for preparation of the foundation.

Metal foundations should be painted to avoid corrosion.

Foundations must be even, and sufficiently rigid to withstand possible short circuit forces. They shall be dimensioned as to avoid the occurrence of vibration due to resonance.

Before mounting the motor, the foundation surface for the shims or for the feet must be clean from thick paint, paint drops and dirt. Then it should be checked in order to discover any height differences between the individual foot locations. Also, the smoothness within each footprint area has to be checked. The requirements are noted in the figure below.



Foundation studs
Bolt the foundation studs to the feet of the motor and place a 1-to-2 mm shim between the stud and the feet.

Align the motor directly using appropriate means. Grout the studs with concrete, check alignment and drill holes for locating pins.

Drain holes
Always check that open drain holes face downward.

In extremely dusty environments, all drain holes should be closed.

2.3.3 Alignment

Correct alignment is essential to avoid bearing failures, vibrations and possible fractured shaft extensions.

2.3.4 Slide rails and belt drives

- Fasten the machine to the slide rails as shown in figure 2.
- Place the slide rails horizontally on the same level.
- Check that the machine shaft is parallel with driven, or driving, shaft.
- Any belt must be tensioned according to the supplier's instructions.

WARNING
Excessive belt tension will damage bearings and can cause shaft breakage.

Do not exceed the maximum belt forces (i.e. radial bearing loading) stated in the relevant product catalogues.

2.4 Connection

Normal machine design has the terminal box on top with cable entry possible from both sides.

Some machines are available with top mounted terminal boxes rotatable 4 x 90°, and some with side mounted terminal boxes.

Availability of these solutions is described in the product catalogues.

Unused cable entries must be closed.

As well as main winding and earthing terminals, the terminal box can also contain connections for thermistors, standstill heating elements, bimetallic, switches, or PT 100 resistance elements.

WARNING
Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

Connection diagrams for auxiliary elements are found inside the terminal box cover or in additional labels on the frame of the machine.

WARNING
The capacitor in single-phase motors can retain a charge that appears across the motor terminals, even when the motor has reached standstill.

2.4.1 Connection for variable speed drive

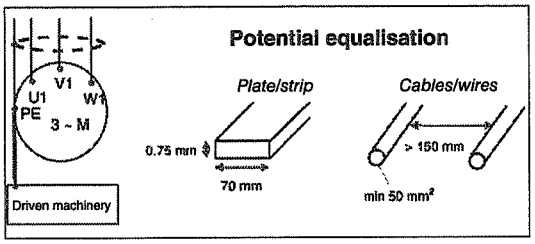
Variable speed drives cause higher voltage stresses than the sinusoidal supply on the winding of the motor and may cause high frequency shaft voltages and bearing currents. Therefore the winding and the bearing insulation of the motor as well as the filter at the converter output must be dimensioned according to "Selection rules for VSD applications/Insulation" (3GZF500930-2), available on request from ABB.

In variable speed drives the motor (Pn > 30 kW) must be cabled by using shielded symmetrical cables and cable glands providing 360° bonding (also called EMC glands). More information can be found in ABB's manual "Grounding and cabling of the drive system" (3AFY61201998).

In frequency converter applications motor frame external earthing must be used for equalising the potential between the motor frame and the driven machine, unless the two machines are mounted on the same metallic base.

For motor frame sizes above IEC 280, use 0.75 x 70 mm flat conductor or at least two 50 mm^2 round conductors. The distance of the round conductors must be at least 150 mm from each other.

This arrangement has no electrical safety function; the purpose is to equalise the potentials. When the motor and the gearbox are mounted on a common steel fundament, no potential equalisation is required.



To comply with EMC-requirements, use only cables and connectors approved for this purpose. (See instruction for frequency converters.)

The highest permissible rotational speed of a cast iron motor used in variable speed drive (M2BA/M3BP) must not exceed maximum permissible speeds as stated in the table 2 below or the speed stamped on the rating plate. For information on the highest permissible rotational speed for other motor sizes and types, please contact ABB. Bearing lubrication should follow the directions mentioned later.

Frame size	Speed r/min 2 pole	4 pole
280	3600	2600
315	3600	2300
355	3600	2000
400	3600	1800
450	3600	1800

Table 2

If there is uncertainty concerning the suitability of the motor for the variable speed drive, please contact ABB.

WARNING
The maximum operating temperature of the grease and bearings must not be exceeded.

2.5 Balancing

The rotor of the machine is dynamically balanced.

As standard, balancing has been carried out using **half key,** and the shaft is marked **with a RED tape,** with the text "Balanced with half key". In case of motors delivered without any tape defining the type of balancing, these motors are also balanced with **half key**.

To avoid vibration the coupling-half or pulley must be balanced with half key after the keyway has been machined.

In the event of balancing **with full key** the shaft is marked **with a YELLOW tape,** with the text "Balanced with full key".

In case balancing **without key,** the shaft is marked **with a BLUE tape,** with the text "Balanced without key".

3. Operating

3.1 Use

3.1.1 Operating conditions

The machines are intended for use in industrial drive applications.
Normal ambient temperature limits are -20° to +40°C.
Maximum altitude 1000 m above sea level.

3.2 Safety considerations

The machine is intended for installation and use by qualified personnel, familiar with relevant safety requirements.

Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with the local regulations.

WARNING
Small motors with supply current directly switched by thermally sensitive switches can start automatically.

3.2.1 Points to observe

1. Do not use the machine to step on.
2. The temperature of the outer casing of the machine may be hot to the touch during normal operation.
3. Some special machine applications require special instructions (e.g. using frequency converter supplies).
4. Lifting lugs must only be used for lifting the motor. They must not be used to lift the motor when it is attached to other equipment.

3.3 Assembly and dismantling

3.3.1 General

Dismantling and assembly of machines must be carried out by qualified personnel using only suitable tools and working methods. All repairs must be carried out according to the standard IEC-60079-19.

3.3.2 Bearings

Special care should be taken with the bearings. These must be removed using pullers and fitted by heating or using special tools for the purpose.

How to replace bearings is described in detail in a separate instruction leaflet available from ABB Sales Office.

3.3.3 Fitting coupling halves and pulleys

Coupling halves and pulleys must be fitted using suitable equipment and tools that do not damage the bearings.

Never fit a coupling half or pulley by hammering into place or remove it using a lever pressed against the body of the machine.

Mounting accuracy of coupling half:

check that the clearance **b** is less than 0.05 mm and that the difference **a1** to **a2** is also less than 0.05 mm. See figure 3.

4. Maintenance

4.1 Maintenance and lubrication

4.1.1 General inspection

- Inspect the machine at regular intervals.
- Keep the machine clean and ensure free ventilation airflow.
- Check the condition of shaft seals (e.g. V-ring) and replace if necessary.
- Check the condition of connections and mounting and assembly bolts.
- Check the bearing condition by listening for unusual noise, vibration measurement, bearing temperature, inspection of spent grease or SPM bearing monitoring.
  * When changes of condition occur, dismantle the machine, check the parts and replace if necessary.

4.1.2 Lubrication

WARNING
Beware of all rotating parts!

WARNING
Grease can cause skin irritation and eye inflammation. Follow all safety precautions specified by the manufacturer.

4.1.3 Machines with permanently greased bearings

Bearings are usually permanently greased bearings of either Z or 2Z types.

Bearing types are specified in the respective product catalogues and on the rating plate of all our motors except smaller frame sizes.

As a guide, adequate lubrication for sizes up to 200 can be achieved for the following duration, according to L1 (i.e. that 99 % of the motors are sure to make the interval time) at ambient temperature of 25°C. For duties with ambient temperatures higher than 25°C, see the respective product catalogue.

Frame size	Poles	Duty hours
56-80	2-8	for life
90-112	2-8	40 000
132	2-8	40 000
160	2-8	40 000
180	2-8	40 000
200	2	27 000
200	4	40 000

Table 3

Depending on application and load conditions, see applicable product catalogue.

Hours of operation for vertical motors are half of the above values.

Motors with roller bearings have considerably shorter grease life. For continuous operation regreasing nipples should be considered.

4.1.4 Motors with regreasing nipples

Lubrication information plate and general lubrication advice

If the machine is fitted with a lubrication information plate, follow the given values.

On the lubrication information plate, regreasing intervals with regard to mounting, ambient temperature and speed of rotation can be defined.

During the first start or after a bearing lubrication it may appear a temporary temperature rise, appr. 10-20 hours. ABB policy is to have reliability as a vital issue in bearing lubrication intervals. That is why we follow the L1-principle.

A. Manual lubrication

Regreasing while motor is running
- Remove grease outlet plug or open closing valve if fitted.
- Be sure that the lubrication channel is open
- Press the specified amount of grease into the bearing.
- Let the motor run 1-2 hours to ensure that all excess grease is forced out of the bearing. Close the grease outlet plug or closing valve if fitted.

Regreasing while motor is at a standstill
Regrease motors while running. If this is not possible, lubrication can be carried out while the machine is at a standstill.
- In this case, use only half the quantity of grease, then run the motor for a few minutes at full speed.
- When the motor has stopped, press the rest of the specified amount of grease into the bearing.
- After 1-2 running hours close the grease outlet plug or closing valve if fitted.

B. Automatic lubrication
The grease outlet plug must be removed permanently with automatic lubrication or open closing valve if fitted.

Some motors may be equipped with a collector for old grease. Follow the special instructions given for the equipment.

We recommend only the use of electromechanical systems. Contact your local ABB Sales Office.

The amount of grease per each lubrication interval stated in the tables 4-5 should be doubled if an automatic regreasing system is used.

If 2-pole motors are being automatically regreased, the note (NOTE!) concerning lubricant recommendations given for 2-pole motors in the chapter Lubricants shall be followed.

4.1.5 Lubrication intervals and amounts

Frame size	Amount of grease g/bearing	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
	Ball bearings						
	Lubrication intervals in duty hours						
112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	70	2000[1]	3500[1]	8000	10500	14000	17000
315	90	[1]	[1]	6500	8500	12500	16000
355	120	[1]	[1]	4200	6000	10000	13000
400	120	[1]	[1]	4200	6000	10000	13000
400 M3BP	130	[1]	[1]	2800	4600	8400	12000
450	140			2400	4000	8000	8800

Table 4

	Roller bearings						
	Lubrication intervals in duty hours						
160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	70	1000[1]	2000[1]	4000	5300	7000	8500
315	90	[1]	[1]	3300	4300	6000	8000
355	120	[1]	[1]	2000	3000	5000	6500
400	120	[1]	[1]	2000	3000	5000	6500
400 M3BP	130	[1]	[1]	1400	2300	4200	6000
450	140			1200	2000	4000	4400

Table 5

[1] Values for IEC sizes 280 to 450 (cast iron and steel motors) in certain motor types (3600 and 3000 r/min), see tables 6-7.

Lubrication intervals and amounts, 2-pole, IEC frame sizes 280 to 450

Frame size		Amount of grease g/bearing	3600 r/min	3000 r/min
	Ball bearings			
	Lubrication intervals in duty hours			
280	M2B*, M2C*, M3B*	35	2000	3500
315	M2B*, M2C*, M3B*	35	2000	3500
355	M2B*, M2C*	45	1200	2000
355	M3B*	35	1200	2000
400	M2B*, M2C*	45	1200	2000
400	M3B*	40	1000	1600
450	M3B*	40	1000	1600

Table 6

	Roller bearings			
	Lubrication intervals in duty hours			
280	M2B*, M2C*, M3B*	35	1000	1800
315	M2B*, M2C*, M3B*	35	1000	1800
355	M2B*, M2C*	45	600	1000
355	M3B*	35	600	1000
400	M2B*, M2C*	45	600	1000
400	M3B*	40	500	800
450	M3B*	40	500	800

Table 7

Factors influencing the lubrication intervals
Lubrication intervals for vertical machines are half of the above values.

The lubrication intervals are based on bearing operating temperature 80°C (ambient temperature of about + 25°). Note! An increase in the ambient temperature raises the temperature of the bearings correspondingly. The values should be halved for 15°C increase in bearing temperature and may be doubled for 15°C decrease in bearing temperature.

WARNING
The maximum operating temperature of the grease and bearings must not be exceeded.

4.1.6 Lubricants

WARNING
Do not mix different types of grease.
Incompatible lubricants may cause bearing damage.

When regreasing, use only special ball bearing grease with the following properties:
- good quality grease with lithium complex soap and with mineral- or PAO-oil
- base oil viscosity 100-160 cST at 40°C
- consistency NLGI grade 1.5 - 3 *)
- temperature range -30°C - +120°C, continuously.

*) For vertical mounted motors or in hot conditions a stiffer end of scale is recommended.

Grease with the correct properties is available from all major lubricant manufacturers.

Admixtures are recommended, but a written guarantee must be obtained from the lubricant manufacturer especially concerning EP admixtures, that admixtures do not damage bearings or the properties of lubricants at the operating temperature range.

WARNING
Lubricants containing EP admixtures are not recommended in high bearing temperatures in frame sizes 280 to 450.

If the ambient temperature is below -25°C or above +55°C, or bearing temperature is above 110°C, consult ABB Sales Office regarding suitable grease.

The following high performance grease can be used

- Esso Unirex N2, N3 or S2 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Albida EMS 2 (lithium complex base)
- SKF LGHQ 3 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP110 (lithium complex base)

Lubrication intervals for other grease fullfilling the required properties, contact your local ABB Sales Office.

NOTE!
Always use high speed grease for high speed machines and some other models, e.g. M2BA 355 and 400 2-pole machines, where the speed factor is higher than 400 000 (calculated as Dm x n where Dm = average bearing diameter, mm; n = rotational speed, r/min).

The following grease can be used:
- FAG L69 (polyurea base)
- Klüber Klüber quiet BH 72-102 (polyurea base)
- Lubcon Turmogrease PU703 (polyurea base)

If other lubricants are used, check with the manufacturer that the qualities correspond to those of the above mentioned lubricants, or if the compatibility of the lubricant is uncertain, contact your local ABB Sales Office.

WARNING
Especially in high rotational speed (the speed factor > 400000) over greasing may cause damage.

4.1.7 Frequency converter drives

Higher speed operation, e.g. in frequency converter applications, or lower speed with heavy load will require shorter lubrication intervals. Consult your local ABB Sales Office in such cases.

Typically a doubling of speed will require a reduction of lubrication intervals to approx. 40 % of values tabulated above.

WARNING
The constructional maximum speed of the motor must not be exceeded (see table 2).

Suitability of bearings for high speed operation must be checked.

4.1.8 Spare parts

When ordering spare parts, the full type designation and product code, as stated on the rating plate, must be specified.

If the machine is stamped with a serial manufacturing number, this should also be given.

For more information, please visit our web site www.abb.com/partsonline.

4.1.9 Rewinding

Rewinding should always be carried out by qualified repair shops.

Smoke venting and other special motors should not be rewound without first contacting ABB.

5. Environmental requirements

5.1 Noise levels

Most of our motors have a sound pressure level not exceeding 82 dB(A) refer to 50 Hz sinusoidal supply conditions, tolerance ± 3 dB(A).

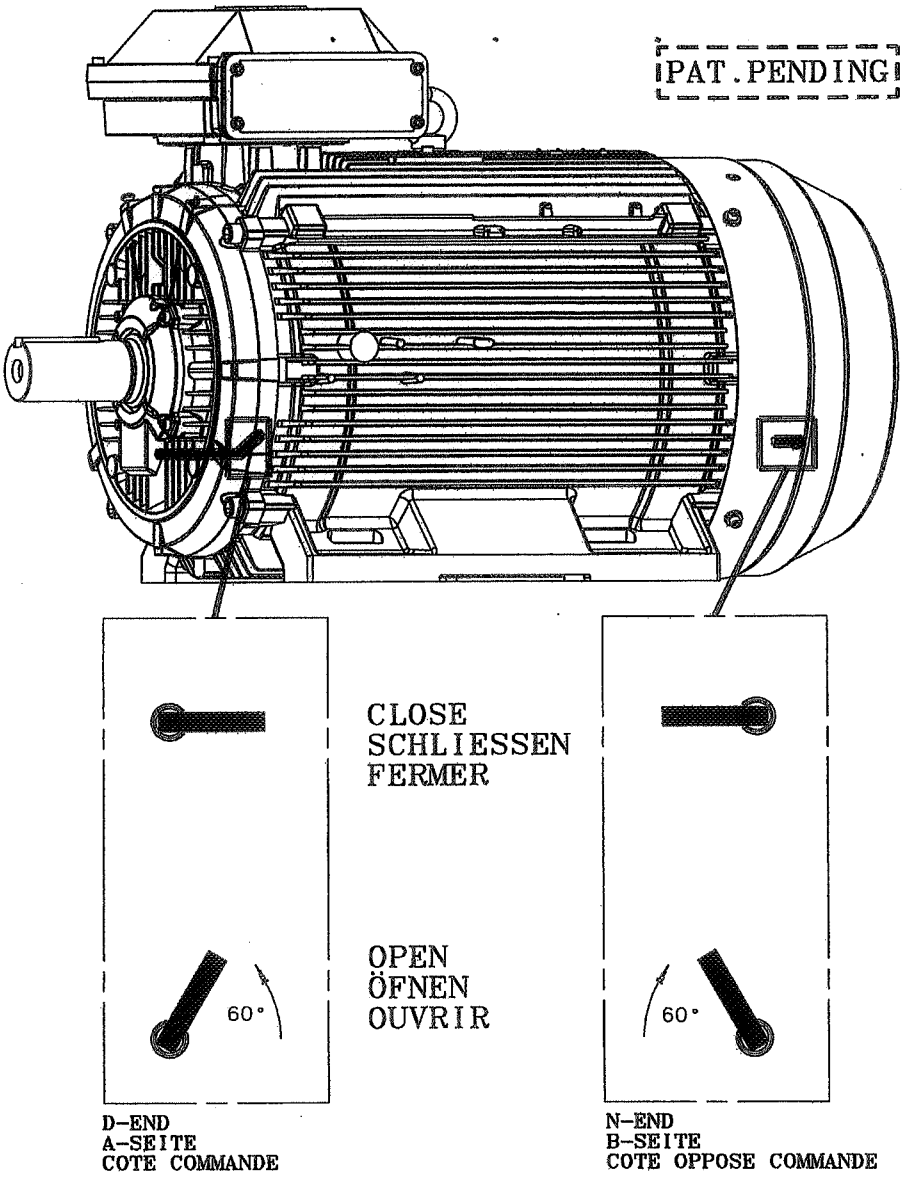
Values for specific machines can be found in the relevant product catalogues.

For sound pressure levels for 60 Hz sinusoidal supply and with non-sinusoidal supplies, contact ABB Sales Office.

Sound pressure levels for all machines having separate cooling systems and for series M2F*/M3F*, M2L*/M3L*, M2R*/M3R*, M2BJ/M3BJ and M2LJ/M3LJ are indicated in separate Manuals.

Part no: N8776-001txt Item:

GREASE OUTLET
FETTAUSGANG
EVACUATION DE LA GRAISSE



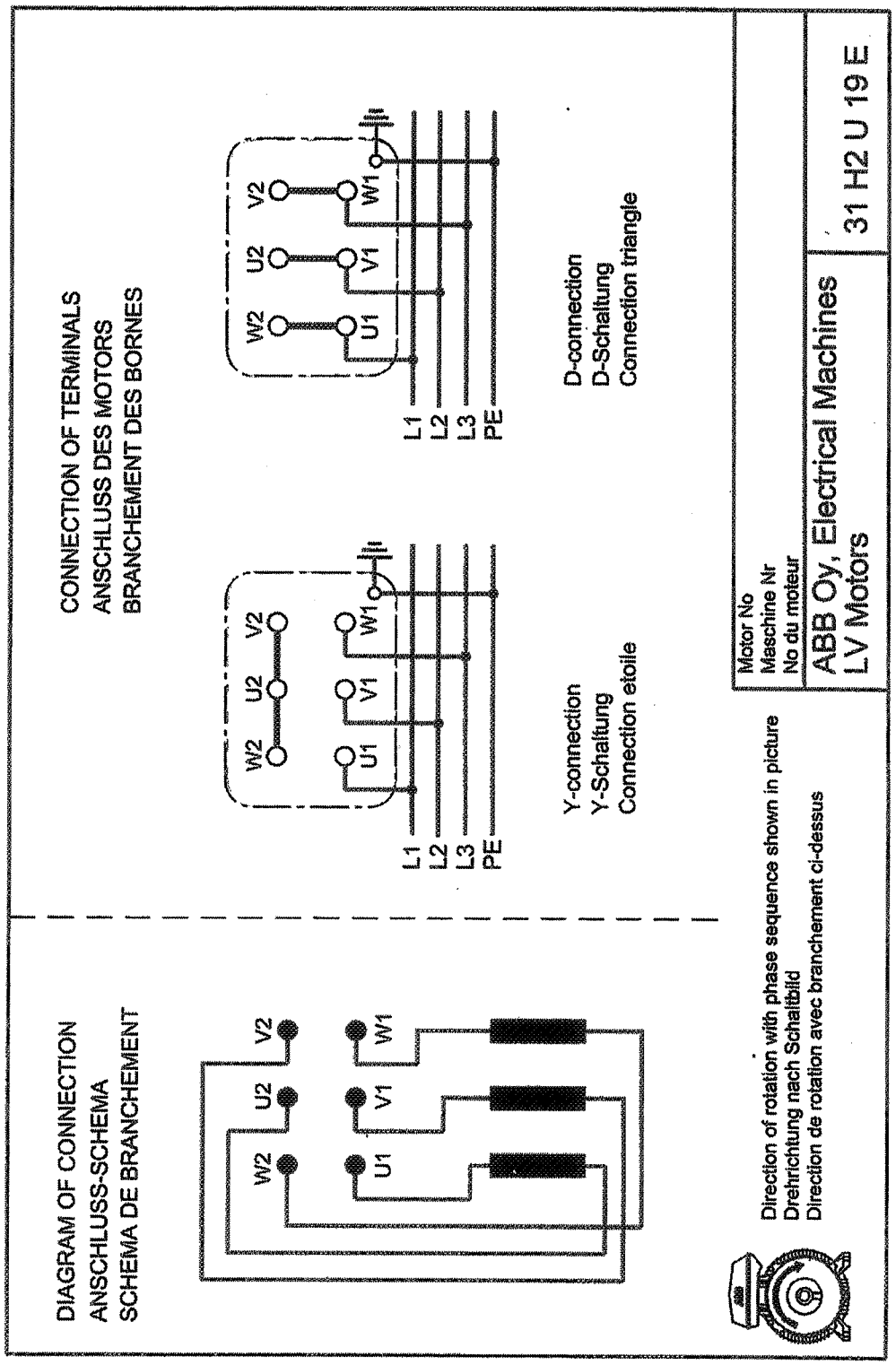
6. Troubleshooting

These instructions do not cover all details or variations in equipment nor provide for every possible condition to be met in connection with installation, operation or maintenance. Should additional information required, please contact the nearest ABB Sales Office.

Motor troubleshooting chart
Your motor service and any troubleshooting must be handled by qualified persons with proper tools and equipment.

TROUBLE	CAUSE	WHAT TO DO
Motor fails to start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter.
	Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
	Improper line connections	Check connections with diagram supplied with motor.
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also, ensure that all control contacts are closed.
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
	Short circuited stator Poor stator coil connection	Indicated by blown fuses. Motor must be rewound. Remove end bells, locate with test lamp.
	Rotor defective	Look for broken bars or end rings.
	Motor may be overloaded	Reduce load.
Motor stalls	One phase may be open	Check lines for open phase.
	Wrong application	Change type or size. Consult manufacturer.
	Overload	Reduce load.
	Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	Open circuit	Fuses blown, check overload relay, stator and push buttons.
Motor runs and then dies down	Power failure	Check for loose connections to line, to fuses and to control.
Motor does not come up to speed	Not applied properly	Consult supplier for proper type.
	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
	Starting load too high	Check load motor is supposed to carry at start.
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.
Motor takes too long to accelerate and/or draws high amp	Excessive load	Reduce load.
	Low voltage during start	Check for high resistance. Adequate wire size.
	Defective squirrel cage rotor	Replace with new rotor.
	Applied voltage too low	Get power company to increase power tap.
Wrong rotation	Wrong sequence of phases	Reverse connections at motor or at switchboard.

Part no: N8776-001txt Item:



ABB

EC Declaration of Conformity

The Manufacturer: ABB

hereby declares that

The Products: 3-phase induction motors
series M2B* with product code pos. 14 = A, D, E or U
center heights 160, 180, 200, 225, 250, 280, 315, 355 and 400 mm,
Nema-sizes 32_, 36_, 40_, 44_, 50_, 58_
series M3B* with product code pos. 14 = G
center heights 160, 180, 200, 225, 250, 280, 315, 355 and 400 mm
series M2C*, M2F*, M2L* and M2R* with product code pos. 14 = A
center heights 200, 225, 250, 280, 315, 355 and 400 mm.
series M2C* with product code pos. 14 = A
Nema-sizes 40-, 44_, 50_, 58_

are in conformity with provisions of the following Council Directives:

Low Voltage Directive 73/23/EEC (amended by 93/68/EEC),

and, as components, with the essential requirements of the following :

EMC Directive 89/336/EEC (amended by 92/31/EEC and 93/68/EEC), regarding the intrinsic characteristics to emission and immunity levels,

and are in conformity with : EN 60 034-1

Additional Information :-

By design, the machines, considered as components, comply with the essential requirements of

Machinery Directive 98/37/EEC provided that the installation be correctly realised by the manufacturer of the machinery (for example: in compliance with our Installation Instructions and EN 60 204 "Electrical Equipment of Industrial Machines").

Certificate of Incorporation (Directive 98/37/EEC, Art 4.2 and Annex II, Sub B) :

The machines above must not be put into service until the machinery into which they have been incorporated have been declared in conformity with the Machinery Directive.

Year of CE marking : CE00.

Signed by Jouni Ikäheimo

Title Product Development Director

Date May 09, 2003

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Example of the Declaration of Conformity given by ABB.

CE

ABB

EC Declaration of Conformity

The Manufacturer :- *(Name and address of the manufacturer)*

hereby declares that

The Products :- *(Product identification)*

are in conformity with provisions of the following Council Directives :

Low Voltage Directive 73/23/EEC (amended by 93/68/EEC),

and, as components, with the essential requirements of the following :

EMC Directive 89/336/EEC (amended by 92/31/EEC and 93/68/EEC), regarding the intrinsic characteristics to emission and immunity levels,

and are in conformity with :

EN 60 034-1

Additional Information :-

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Year of CE marking : CE00.

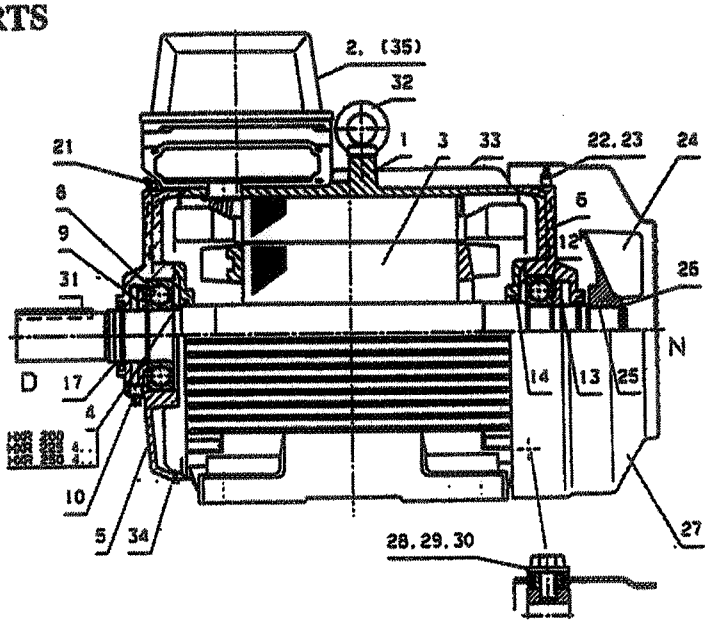
Signed by .....

Title .....

Date .....

Translations into other languages are available from ABB.

SPAREPARTS



1	Stator, complete
2	Stator terminals
3	Rotor with shaft
4	Ring
5/7	Endshield D-end with screws
6/7	Endshield N-end with screws
8	Bearing D-end + N-end
9	Valve disc. D-end + N-end
10	Scaling plug
11	Nave spring washer
13	Locking ring
14/20	Inner bearing cover with screws
17	V-ring D-end + N-end
21/22	Grease nipple D-end + N-end
23	Nipple extension
24	Fan
25	Tolerance sleeve
26	Retaining ring
27	Fan cover
28-30	Rubber bushing with screw
31	Key

SPECIFICATION OF SPARE PARTS REQUIRED:

- **Motor type**
- **Motor no.**
- **Part no.**

TG: Item 109

Technical Data Sheet

Customer: *HamworthyKSE*

Project name:

Customer ref. *Skorge*

Location:

ABB ref. no. *Undefined*

Date: *25.02.2004*

Handled by: *Undefined*

Item Name:

Case: *Undefined*

Revision: *A*

No.	Definition	Data / Unit		Remarks
1	Product	*TEFC, 3-phase, squirrel cage induction motor*		
2	Product code	*3GAA 131 003-ADC*		
3	Type/Frame	*M3AA 132 SC 2*		
4	Mounting	*IM1001, B3(foot)*		
5	Rated output P_N	*11,0*	kW	
6	Rated output	*14,7*	HP	
7	Service factor	*1*		
8	Type of duty	*S1(IEC)*		
9	Rated voltage U_N	*440*	V D	
10	Rated frequency f_N	*60*	Hz	
11	Rated speed n_N	*3455*	r/min	
12	Rated current I_N	*17,5*	A	
13	No-load current	*4,3*	A	
14	Starting current I_s/I_N	*9,1*		
15	Nominal torque T_N	*30*	Nm	
16	Locked rotor torque T_s/T_N	*3,8*		
17	Maximum torque T_{max}/T_N	*3,4*		
18	Minimum torque T_{min}/T_N	*2,4*		
19	Speed at minimum torque	*540*	r/min	
20	Maximum starting time from hot DOL	*15*	s	
21	Maximum starting time from cold DOL	*27*	s	
22	Efficiency - full load 100%	*89,0*	%	Acc. to IEC 60034- 2
23	Efficiency - 75%	*89,0*	%	
24	Efficiency - 50%	*89,5*	%	
25	Power factor - full load 100%	*0,93*		
26	Power factor - 75%	*0,91*		
27	Power factor - 50%	*0,86*		
28	Power factor at start	*0,61*		
29	Insulation class / Temperature class	*F*	*B*	
30	Ambient temperature	*45*	°C	
31	Altitude	*1000*	m.a.s.l.	
32	Enclosure	*IP55*		
33	Cooling system	*IC411 self ventilated*		
34	Bearing DE/NDE	*6208-2Z/C3 - 6208-2Z/C3*		
35	Lubrication / lubricant			
36	Sound pressure level (L_P dB(A) 1m)	*73*	dB(A)	+3dB(A)
37	Moment of inertia J = ¼ GD²	*0,022*	kg-m²	
38	Balancing			
39	Vibration class			
40	Terminal box arrangement			
41	Terminal box entries; no, dimens.			
42	Number of power terminals			
43	Direction of rotation	*CW or CCW*		
44	Weight	*56*	kg	
45	Dimension drawing no.			
46	Additional information			
Ex-motors				
47	Type of protection			
48	Certification No.			
49	t_E time		s	

Option Variant Codes / Definition

Remarks:
Data based on catalogue values 2003-10-02
Guaranteed values on request
File Name: untitled.xls

Page: 1.1

11-104

HamworthyKSE

Part no: M2442-001txt

FG: Item: 103, 104

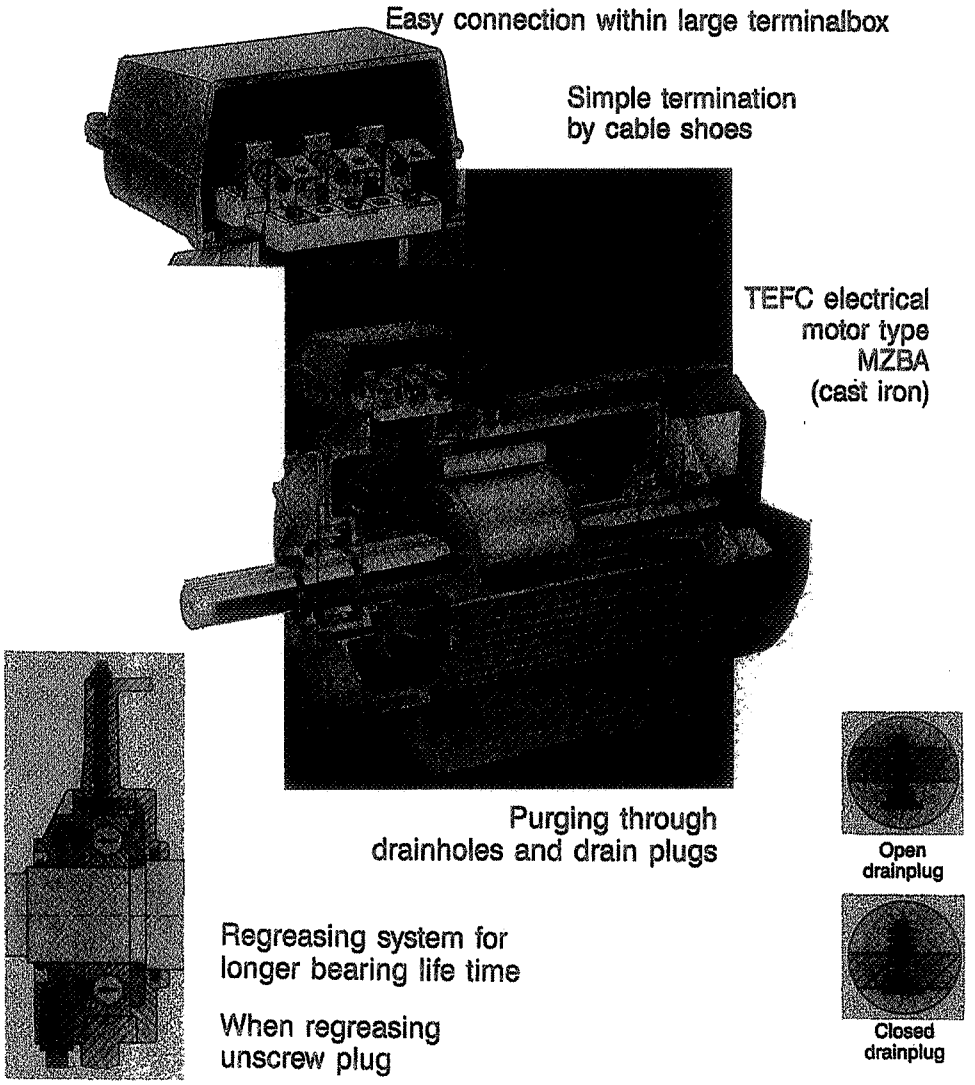
Rev:

TG: 83, 109

Date: 20030314

SQUIRREL CAGE MOTOR

Installation and maintenance



1. GENERAL

The safety equipment required to prevent accidents at the mounting and operating site shall be in accordance with the regulations prevailing in the country conserned.

1.1 Reception

. Check all the data on the rating plate to see that they correspond to your order. Make a special point of checking the voltage, and the connection method. (i.e. star or delta).
. Inspect the motor to see that it has not been damaged in transit.
. Turn the shaft by hand to check it turns freely.

1.2 Transport and storage

The motors must not be exposed to any harmful effects during transport and storage. Motors fitted with cylindrical-roller bearings and/or angular-contact ball bearings are provided with a transport retainer.

Motors in V design with angular-contact ball bearings have to be transported in their service position. If it should become necessary to transport them in a horisontal position, this is only allowed with the transport retainer installed.

Basically, the transport retainer should only be removed when the motor has arrived at the site of installation and when it is in its service position.

If the motors are to be transported over a long distance or stored for a prolonged period of time, we recommend the following precautions:

- Protect the bare surfaces, such as shaft end, flanges, etc. by an additional anti-corrosive coating
- Secure the rotor by means of a transport retainer
- Use special packaging to provide protection against external damage or enviromental influences, e.g. a rugged wood casing with air-tight sealed plastic foil with drying agent and moisture indicator.
- Store the motor in a vibration-free, dry and ventilated room at a uniform temperature whenever possible.

Should you require any further information on "prolonged storage or standstill times before commissioning", please contact the sales offices.

Any damage caused by improper handling is not covered by our guarantee.

2. Installation and commissioning

2.1 Driven units

The rotor of the motor is dynamically balanced with a full featherkey inserted in the shaft end. Driven members designed for mounting on the output shaft must be balanced on a plain spigot. The sensitive antifriction bearings require that couplings, belt pulleys and the like be fitted with the aid of a suitable tool. Should this not be possible, the parts have to be heated to about 60 to 80°C. This allows them to be readily pushed onto the shaft if the bore complies with tolerance range "H". Please take care that, after fitting, these parts have a tight fit, i.e. they do not slide on the shaft. They should be pressed firmly against the stop. If the driven members (pulley, coupling half, pinion or the like) do not cover the full length of the shaft end, this difference should be compensated for by the provision of spacing bushes. Pulleys which are too small or too wide, just like belts with an excessive tension, may damage the bearings and the shaft.

2.2 Installation

The motors must be installed in such a way that the cooling air can freely flow to and away from the motors. Care should be taken to ensure that heated cooling air is not drawn in again.

To retain the specified degree of protection, louvres for the air inlet and outlet openings must be fitted in such a way that the cooling air is taken in from below and the heated air is discharged towards the bottom.

In the case of motors with drain holes for condensed water (special design), care should be taken to ensure that, with the motor in its service position, drain holes are at lowest place.

In the case of motors with the shaft end pointing upwards, protection against the entry of foreign bodies must be ensured either by the driven machine or by the client providing an appropriate cover. The free flow of cooling air must not be obstructed by such measures. If water is liable to occur, additional preventive measures have to be taken to prevent the endtry and/or accumulation of water in the bearing head zone of the drive end.

2.3 Alignment

You can prolong the service life of the motors and particularly of the bearings by aligning them carefully. This applies to motors both with flexible and with non-flexible couplings. Even slight misalignments may very rapidly result in damage to the bearings. Please take also care that the

four feet are evenly loaded. Any unevenness in the base, which tends to lead to undue loading of the bearings, can be compensated for by sheet metal strips.

In the case of flange motors care should be taken to ensure that the motor has a snug fit in the recess and the mounting screws are evenly tightened.

Testing facility

Slowly turn coupling through 360° and note maximum deflection of dial gage pointer (= 2 x Δ r)

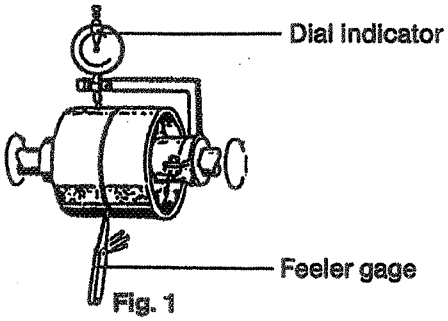


Fig. 1

.4 Permissible vibrations

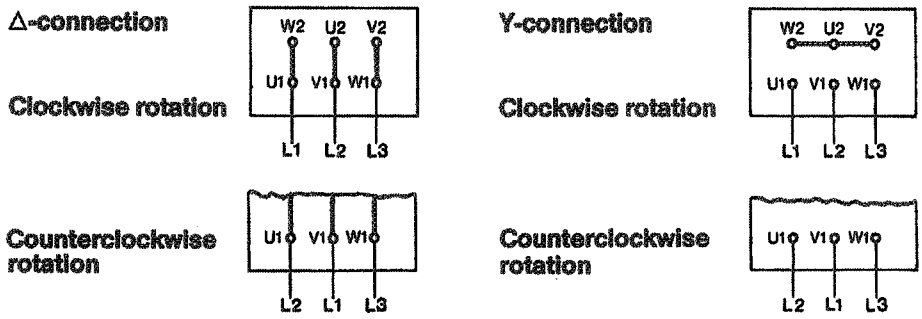
For criteria for the assessment of mechanical vibrations of machines, see VDI 2056.

.5 Sense of rotation and connection

The motor is connected for "Clockwise rotation" in accordance with the new version of VDE 0530 Part 8/July 1987 *. Sense of rotation is defined to mean that direction of rotation of the rotor that is noticed by a person when viewing the face of the only or thicker shaft end.

For Counterclockwise rotation, two phase conductors of the connecting lead have to be reversed in the terminal box.

If a motor is designed for one sense of rotation only, the sense of rotation is marked by an arrow. Indicated below this arrow are the motor terminal markings in the sequence in which they have to be connected with the successive phases (L1, L2, L3).



*

The content of VDE 0530 Part 8/July 1987 agrees with the harmonisation documents HD 53.8, 53.8 S2 and 53.8 S3of the European Committee for Electrotechnical Standardization (CENELEC). This CENELEC harmonisation document is largely based on publication IEC 34-8, 1st edition 1972.

Check the data on the rating plate before connecting the motor. The voltage marked on the rating plate must be in agreement with the supply voltage.

The terminal board is normally equipped with 6 terminals. Details concerning the connection can be seen from the diagram provided in the terminal box. The links have to be installed in accordance with the supply voltage available.

Basically, the star connection is always associated with the higher voltage. When a star-delta starter is used, no links are required on the terminal board, and all 6 terminals are connected to the corresponding terminals of the switch.

Please note that the rating plate must be marked 230/400 VΔ/Y or 230 VΔ in the case of a line voltage of 230 V, and 400/690 VΔ/Y or 400 VΔ in the case of a line voltage of 400 V.

Important
When connection the motor make sure that the stator terminals have at least degree of protection IP 55, or that of the motor if this is higher.

2.6 Motor Protection

You can prolong the service life of your motor by protecting it against short circuits and overloads. We therefore recommend the use of our ABB protective switches and thermal releases.

2.7 Commissioning

Motors which are stored or not operated for a prolonged period of time must not be switched on immediately.. It is essential to measure the insulation resistance before putting them into service.

The insulation resistance must be measured with the supply cable disconnected.

Measurements should be made with V direct voltage, e.g. using a megger with a direct voltage output. The measuring instrument will show the correct insulation resistance value only after some seconds, as a result of the fact that the winding is capacitively charged.

The enclosure, the thermal sensors and all winding sections which have no measuring voltage applied to them should be earthed.

After disconnection of the measuring voltage the tested winding section should be earthed immediately.

If the measured insulation resistance proves to be too low, the insulation of the terminals should first be checked for pollution and humidity. If necessary, the insulation must be cleaned and dried. Thereafter, measurement of the insulation resistance has to be repeated.

If the measured insulation resistance is less than the values given in the table below, the winding must be dried.

Drying can be performed with heated air. However, the air temperature must not exceed 80°C.

Minimum insulation resistance of the complete winding to earth (3 phases to earth) in MOhn for:

Winding temperature	Rated voltage between 2 phase conductors	
° C	220 to 660 Volts	1000 Volts
25	4,0	5,0
80	0,15	0,2

3. Maintenance

3.1 Rolling-contact bearings

Unless the type of grease has been specified in the purchase order or to cope with special load condistions of the bearings, the motor has been

lubricated with bearing grease type Shell Alvania G3 (based on lithium). In the case of motors without relubricating device, which are designed for continuous operation under normal operating conditions and for direct coupling to the machine to be driven, the first filling is sufficient for
20.000 service hours for motors with 4 and more poles
10.000 service hours for 2-pole motors, depending of the service of motor.

Motors with lubricating device are fitted with a plate indicating the intervals at which the motors should be lubricated, together with the quantity of grease to be used.

The rolling-contact bearings are lubricated with grease "Shell Alvania G 3".

Alternatively, any of the following rolling-contact bearing greases can be used for relubrication:

Statoil Uniway EP 2 N
Esso Unirex N3
Mobil Mobilgrease 532
Texaco Hytex EP3

We recommend always to use the same brand of grease for refiilling!

Where onerous operating conditions are involved, e.g. high degree of humidity, comparatively high degree of pollution, high or cyclic loading of bearings, high vibrational stresses, ambient temperature above 40°C, the relubrication intervals should be reduced. The motor should be lubricated while running whereever this procedure does not involve any risk. The used grease will be collected in special chambers provided in the endshields. When the relubrication intervals as well as the quantities of grease to be filled in are strictly observed the chamber will be sufficient to take up the used grease over a period of 20.000 service hours.

It is recommended to have the bearings cleaned and inspected by an expert evey 3 to 5 years. If the motors are exposed to a high degree of humidity, vibrational stresses or comparatively heavy contaimination, the bearings should be cleaned at shorter intervals. For cleaning, petroleum ether (benzine) should be used.

3.2 Cleaning

The cooling air passages (cooling surfaces) must be cleaned at regular intervals depending on the degree of pollution of the cooling air. For surface-cooled motors it is normally sufficient to clean the internal parts during normal overhauls.

The terminal compartment and the insulating parts must be cleaned as and when required. Humidity that may have entered must be removed by drying, and any leaks have to be eliminated.

4. Increased safety motors EExe II

4.1 Motors increased-safety

4.2 Introduction

The present instructions complete the operating and maintenance instruction covering the standard motors from which the safety motors derive and indicate additional measures to be taken when using these special motors.

4.3 Principe of the increased-safety protection

The equipment operating at nominal rating, must under rated operating conditions cause no arcing, sparking, or dangerous overheating and measures must during manufacturing be taken in order to avoid that the a.m. phenomena occur accidentally a high safety factor being taken into account.

4.4 Installation

4.4.1 Compatibility with ambient atmosphere

Except if otherwise stated in the order, the motor is designed to withstand the normal corrosion conditions resulting from a normal ambient atmosphere.

Should any special risk be present, make sure taht the motor has actually been ordered for the real ambient conditions of the site where the motor will be used and take any useful complementary measure to protect the motor (special paint, shelter ...). Do check that the ignition temperature of the gas liable to mix, with the ambient air is higher than the maximum surface temperature indicated on the motor name plate (note that the latter takes a room temperature of 40°C into account).

4.4.2 Mounting

To prevent the risks of sparking or overheating, it is advisable to let only skilled personnel fully aware of this type of equipment carry out the installation in order to:

- Close the casing carefully, in such a manner that the protection levels are really preserved.

- Properly carry out mounting, coupling, alignment and load of driven machine in order to avoid any abnormal operation and mechanical and thermal overloads - even if they are likely to last only temporarily.

4.4.3 Protection against overloads

Make sure that the control and safety apparatus meant for controlling the motor is approved for use in the surrounding atmosphere and that their marked temperature does not exceed the ignition temperature of the ambient atmosphere.

Provide in particular for a line current sensitive protection device against overloads (current exceeding full-load current permanently or during a non negligible time) and against motor stalling. A well determined and time-stable characteristic curve of trigger time in terms of current intensity must be the main feature of the protection device.

Trigger time in case of motor stalling must not exceed the TE time indicated on the motor plate for the corresponding IA locked rotor current which is also indicated.

Make sure that the protection device does operate properly in the time scheduled and check this regularly.

4.5 Maintenance

Programmed maintenance operations covering safety devices and motor itself mus be carried out a regular intervals.

Proceed as follows:

- . Lubricate as indicated in the instructions.
- If the shaft sealing gaskets are worn out, manual, replace them.

In any case do not allow personnel not aware of this kind of equipment to interfere with the machines.

Operate only after the motor and its accessor equipment have been disconnected.
When re-assembling, make sure that the terminal-box sealing gaskets are properly located. Eventually change them so that they can prove effective again.

Check after any dismounting and re-assembling that no friction occurs. Make sure that the motor operates properly by carrying out a no-load operation of half an hour to an hour and that no hot spot can be found.

Check finally, that the safety device operates properly.

5. Flameproof motors EExd II B and EExd II C

5.1 Important notes

Flameproof motors are specially designed to comply with official regulations concerning the risk of explosion. If improperly used, badly connected, or subjected to alterations, even minor, their reliability will possibly become doubful.

Particular standards relating to connection arrangements and use of electrical apparatus with flameproof enclosure must be taken into consideration, and only skilled personell fully acquainted with those standards, should be allowed to handle this kind of apparatus.

It should be noted that the electric motor is certified and specified by its group, which is determined according to the nature of the potentially explosive atmosphere for which it is intended, as well as by its marked surface temperature which has been established for an ambient temperature of 40°C.

Should the motors be installed in an ambient temperature in excess of 40°C, then their maximum surface temperature shall be considered as increased by the difference between the actual ambient temperature and 40°C.

For example: If a motor with a plate showing the temperature 135°C is placed in a room temperature of 60°C then it must be understood that the maximum surface temperature is 155°C.

It is the responsibility of the user to determine which group and which group and which maximum surface temperature have to be chosen for the

- Room temperature must not exceed 40°C (unless otherwise stated when ordering).

- Where necessary, release the shaft by removing its locking screw (if fitted).

- For vertical motors shaft up (IMV6/IM1031), ensure that the motor is protected against dripping, fall or spattering of liquids. Please ask us for particular instructions.

- Mount the coupling sleeve or pulley onto the shaft. This operation should be carried out from hot conditions or using a threaded rod and the tapped hole in the shaft extension. Bring the coupling device up to the shaft shoulder or to the rotating bushing rest, if any.

5.2.1 Belt drive

- Use a thoroughly balanced pulley, (see note).
- Avoid using pulleys of small diameter.
- Check the alignment of the pulleys.
- Mounting the motor on slide-rails allows easy adjustment of belt tension.
- Always check the shaft end stresses by measuring the belt elongation, and make sure that these stresses remain within the acceptable limit for the motor involved.
- For frame size > 355 only coupling to be used for motors which speeds exceeds 1800 rpm (4 p).

Attention: Motor coupling by means of pulleys or pinions (not to mention possible sparking due to electrostatic charges especially in case of flat belts) is as a rule not recommended for flameproof motors because of the reduced values specified for safe gaps through the endshields in the regulations in force. As operating risks get greater and greater as clearances get smaller, couplings of this kind must by all means be discarded whenever EExd II C motors (i.e. motors meant for hydroget, acetylene or carbon disulphide atmospheres) are concerned.

5.2.2 Direct coupling by a coupling-sleeve

- Use precision machined and well balanced coupling-sleeves (see note).
- Carefully check alignment of motor shaft in relation to that of the driven machine.
  At 3000 or 3600 rpm, the alignment defect should not exceed 0,05 mm; at lower speeds the alignment defect can be higher (about twice as much).
- The possible effect of heat expansion should be considered when adjusting the shaft heights from cold state or from warm state according to the duty conditions of the whole unit.
- Make sure that axial thermal expansion is not likely to cause abnormal stresses in the bearings.

Note: The motor is balanced with full key.

5.3 Connections

- It is the final user's responsibility to respect the regulations in force concerning connections of electrical apparatus with flameproof enclosure.
- Select power cables of adequate size in order to avoid excessive voltage drop.
- Make sure that the cable gland is so fitted to the power cable that no backlash is present and the sealing ring is thoroughly compressed. Clamp the cable by means of the cable clamp.
- Connect the cables to the motor terminals according to the connecting plate (under the terminal box cover) or, in case of special connections, according to the wiring diagram provided in the terminal box.
- An earthing-screw is available inside the cable box to connect the earth cable.
- Connection of the earth-wire should be made to the terminal marked and located on the motor outside.
- The terminal box must be quite waterproof, particularly if the motor is meant for outdoor installation. Never use a sealant which may hardon between terminal box cover and bottom. (Only use Silicon grease for EExd motors).

5.3.1 Auxiliaries connection

Connect auxiliaries, if fitted (e.g. thermistors, heaters etc...) to the control or protection device, in accordance with the instructions and the wiring diagrams inside the terminal box cover.

Note: For a protection by PTC sensors, the connection must be carried out through an adequate relay.

5.3.2 Additional requirement for motor type EExde

Those motors which are fitted with increased safety "e" terminal box will have an additional plate marked attached to the terminal box lid/cover.

Particular care and attention is necessary when making cable connections:

- Check especially th clamping of cable connections and pay particular attention to the minimum clearances required between live parts (>10 mm.).
- Follow any connection instructions on the diagram which may be attached to this manual.

5.4 Maintenance

Check that there is no obstruction interfering with the ventilation and clean the motor at regular intervals.

5.4.1 Motors with drain plugs for condensation water

These devices are, on request, located at the lower part of the motor to allow condensed water, if any, to flow out.

Frame sizes 160 - 400

Drain plugs located at the lower part of the endshields.
Periodically turn the knurled head of the drain plug in order to prevent jamming.

The number of interventions is depending on the humidity level in the ambient air and the specified weather conditions. It can only be determined experimentally and, once determined, must be strictly adhered to.

5.4.2 Motor protection against corrosion

Should the ambient atmosphere be agressive and corrosive, possibly affecting the joints between components of the flameproof enclosure or between shaft and walls of the flameproof enclosure, then check regularly during service that flameproof joints are not damaged.

5.4.3 Motor protection against overload and stalling

Motors should be protected by a line current sensitive device against overloads and against motor stalling. Such devices should have a tripping time with an accuracy within the range +/-20%. as well as a good reliability.

5.4.4 Motor maintenance

No dismantling shall be carried out on a flameproof motor before the current has first been cut off. Respect the possible indicated waiting time before motor opening.

The final user has the reponsibility to ensure that the apparatus remains in conformity with the reulations in force.

Any repair should be done either under the responsibility of the end user who has to preserve the conformity of the motor, or under the repsonsibility of a repair shop, who has to deliver a certificate stating that the apparatus conforms to the specifications laid down in its certificate of conformity.

Any repair done by the end user during the period of guarantee, unless expressly approved by the manufacturer, does release the manufacturer from his responsibility regarding conformity.

6 PROLONGED STORING

Construction and production of the ABB motors are based on the latest technological advances. For order implementation, we take the specifications submitted to us into account.

The ABB quality assurance system integrated to meet maximum requirements ensures that systematic fault prevention is carried out during all phases of product manufacture.

This leads to high reliability and long service life of the motor.

The existing trend, especially in plant construction, to store the motors several years prior to commissioning or install it to some units already, result in the fact that the motors are exposed to influences, which cannot be assessed in advance for this period of time.

Another essential factor is transportation, which is outside our sphere of influence. For example, transportation of the motor or constructional unit with motor can be performed as combined shipping to site by the general contractor.

The stress (atmospherical, chemical, thermal, mechanical) exerted on the motor, which may occur during transportation storage, mounting, trial operations and standstill until commissioning in various and superimposed ways, is difficult to assess.

The hollow spaces of the motor (interior motor space, rolling-contact bearing and terminal box space) are exposed to atmospherical air and temperature fluctuations. Due to the air humidity, formation of condensation is possible, and depending on type and degree of air contamination, aggressive substances may penetrate into the hollow spaces.

This may have as a consequence that after prolonged periods of time internal components, such as the rolling-contact bearing, have rust deposits, the insulation resistance of the winding decreases to an inadmissibly low value, the lubricity of the grease for rolling-contact bearings is adversely affected.

The described influences increase the damage risk prior to commissioning of the plant.

In order to be able to maintain the manufacturer's guarantee, it must be ensured that the preventive measures described in these instructions, such as
- constructional design

- conservation, packing, storage and
- inspection

are taken.

For performance of the preventive measures it is recommendable to get into contact with us.

6.1 Scope of validity

These instructions are valid for motors with prolonged storage and/or standstill periods prior to commissioning.

In addition to these instructions, the operating instructions supplied along with the motor must be adhered to.

6.4 Measures for prevention and elimination of adverse effects

6.4.1 Technical alternatives

These are constructional characteristics and properties, which are suitable for the prevention of stresses occurring in various manners, e.g.

- Degree of protection: sealing of bearing and interior space
- Selection of materials: insulating materials, greases for rolling-contact bearings
- Monitoring equipment: PTC sensors, SPM monitoring system
- Winding protection: impregnation, anti-condensation heater, condensate drain
- Protection against corrosion: appropriate coating according to the stress conditions
- Equipment for protecting the motor during transportation: base with rubber-metal vibration damper, bearing locking device
- Conservation and packing: foil welding, desiccant.

6.4.2 Protection on motor

6.4.3 Protection of bare surfaces

All bare surfaces (e.g. shaft extension) have been coated in the factory with a temporary protective agent.

Removed and/or damaged protective coats must be reapplied or touched up at once.

Protection period in the case of a coat thickness of about 100 um without cover or packing *)	Inside storage	Up to 5 years
	Outside storage (free weathering)	Up to 2 years

*) In the case of additionally provided packing, the protection period is longer.

6.5 Protection to be provided for storage in unpacked condition

If the motors are stored in unpacked condition, the ambient conditions must be as follows:

- Closed storage room with roof
- Ventilation system with filter
- Constant temperature (temperatur limits => 5°C, =< 60°C)
- No sudden temperature fluctuations
- Relative air humidity =< 50%
- Prevention of dirt and dust deposits
- No aggressive fumes
- No vibrations, since otherwise there is a risk of chatter marks formation (brinelling) on the contact surfaces of the rolling-contact bearing. If the location is not free from vibrations, the motor must be provided with a protection for transportation.

It is recommendable to regularly check the climatic conditions and the condition of the motors at specific intervals (also see paragr. ???)

The temporary protective coat applied to bare surfaces (especially fitting surfaces) must be checked at regular intervals and, if required, touched up (see paragr. 1.4.3).

If most of the afore-mentioned conditions are not given, a protective packing in accordance with paragraph 1.6 is required.

6.6 Protection by packing

6.6.1 Type of packing

The packing described in this case has proven well and can be recommended. It consists of the following:

Wooden box or similar container, insulating-coating foil, quantity of desiccant, moisture indicator and foil welding.

If there is a risk of infestation and formation of mould fungus, the packing must be protected at the storage location by spraying or painting it with appropriate chemical agents.

Preparation of packing must be done with greatest care by an experienced person. Packing must therefore be performed by a packing company which takes over liability.

6.6.1.1 Insulating coating material

- Polyethylene (PE) foil thickness => 0.2 mm to TL 8135-019
  Water vapour permeability =< 0.4 g/m2 x 24 h
  Qualification certificate must be submitted

  Application:
  In the case of storage and shipping periods of up to 6 months under normal stress, test atmosphere E (20°C and 85% relative humidity) in climatic zone A and, with restrictions, climatic zone B (see table in paragr. 1.6.1.2).

- Aluminium bonding sheet class 1, type A to TL 8135-003
  Water vapour permeability =< 0.1 g/m2 x 24 h
  Qualification certificate must be submitted
  Application:
  In the case of storage and shipping periods exceeding 6 months, especially in extremely unfabourable climates (countries belonging to climatic zone B) and in countries with low infrastructure (deficient harbour and public transportation conditions).

6.6.1.2 Desiccant quantity and period of protection

The desiccants contained in bags are standardized to DIN 55473.

The guide values given in the following table have been determined according to a proven calculation method on the basis of the American specification MIL-P-116 and of TL 8100-004.

(The DIN 55474 was not used as a basis for calculation of the guide values, since in most cases the transportation and storage periods as well as the exact individual climate data were not known. If, however, on DIN basis a warranty of fitness must be given, these values must be determined in accordance with DIN 55474).

Climatic zone	A MODERATE	B TROPICAL AND SUB-TROPICAL
Minimum storage requirements	Covered, protected against rain and snow	Covered, protected against rain and - if required - against infestation and formation of mould fungus (also see paragr.)
Desiccant quantity TME/m2 *) Insul. coat	8	17
TME/kg *) packing aid	20	20
Period of protection PE-foil	6 months	6 months (only in cases where micro-climate is identical with zone A) (also see paragr.)
Period of protection Al-foil	36 months	36 months

*) TME = desiccant unit to DIN 55473

Only in cases where particularly unfavourable climatic conditions are to be expected during the protection period, the desiccant quantity should be increased.

6.6.1.3 Moisture indicator

The moisture indicator must permit reading of the relative air humidity of 30%, 40% and 50%.

Limit value:
The relative air humidity inside the packing must not exceed 50% until the motor is unpacked.

6.6.1.4 Foil welding

The foil is welded by using a heat pulse device or hot-sealed. By sucking off part of the air, tightness of the insulating coating can be checked and, in

addition to that, the enclosed quantity of water can be reduced. The resulting condition must not remarkably change within one hour.

6.7 Inspection during storage

Inspections should be performed at regular intervals, in order to ensure that quality of the packing and the motor is maintained. Any detected deficiencies must be eliminated at once.

During inspection the following characteristics must be especially checked:

- Identification, storage period
- Condition of packing (e.g. insulating coating made of foil)
- Protective coat and protective agents
- Desiccant by checking the moisture indicator
- Mechanical damage
- Cleanness

If the limit value of the relative air humidity (see paragr. 6.6.1.3) is exceeded, the desiccant must be replaced and the enclosing foil must be welded again.

6.8 Checking of winding

Prior to commissioning - not only after prolonged storage or standstill period - insulation resistance of the winding must be measured.

New dry windings have, at a winding temperature of 25°C, insulation resistance of 200 MΩ to > 1000 mΩ.

If the insulation resistance approaches the minimum value (see table 1), this may be caused by humidity and/or contamination.

If the insulation resistance is smaller than the values indicated in the following table, the winding must be dried. Drying should, if possible, be performed by using hot air. When doing so, the air temperature must not exceed a maximum value of 80°C. If there is no suitable drying oven available, the motor winding can also be dried by using the heat of current taken from the supply system under specific prerequisites in accordance with the ABB operating instructions GSE 1 067 107.

Table 1 - Minimum insulation resistance of the "complete winding to frame"

Winding temperature	Rated voltage UN 220 to 1000 V
25	10.0 MΩ
80	0.4 MΩ

The insulation resistance strongly depends on the temperature. In the case of new windings, it falls to about half per temperature increase of 10 K.

Measurement is to be performed by using 500 V DC or a hand-driven generator with DC voltage output. Due to capacitive charging of the winding, the measuring instrument indicates the correct value of the insulation resistance only after several seconds.

The frame and all winding parts, which are not connected to measuring voltage, as well as the temperature sensors must be earthed.

After disconnection of the measuring voltage, the tested winding part must be "immediately" earthed.

6.9 Checking of anti-friction bearing

6.9.1 Sampling schedule

For checking the anti-friction bearing, the motor must be dismantled. In order to carry out this check on an economic basis, the following sampling schedule AQL 1.0 (standard) DIN 40080 may be adhered to.

In this case, the samples must be taken representatively from the total batch N (e.g. complete plant).

N	Sample	AQL 1.0 Permissible number of values exceeding the limit value
2 15	N	0
16 150	13	0
151 500	50	1

N = batch size (total batch)
AQL = acceptable quality level

6.9.2 Grease for anti-friction bearing

The results of the existing long-term stability tests performed with the grease for rolling-contact bearings used by us, KL3R DIN 51502 (e.g. Shell Alvania G3) and under the storage conditions described in paragraphs 6.5 and 6.6 show, that at a standstill period of totally 3 years after delivery of the motors there is no significant change of the grease.

In the case of periods exceeding 3 years or aggravated storage conditions, which are worse than described in paragraphs 6.5 and 6.6, the grease must be checked and, if required, replaced.

Reliable usability of grease for rolling-contact bearings, KL3R DIN 51502 (e.g. Shell Alvania G3), after prolonged storage is to be determined in accordance with the limit values (see table 2 given in the following).

Table 2 - Checking of anti-friction bearing grease and limit values

No.	*Quality characteristic*	*Unit*	*Checking method*	*Limit value*
1	Worked penetration (quarter-cone penetration)	0.1 mm	DIN 51804	220 to 250 (converted to cone penetration to DIN ISO 2137)
2	Cleanness, moisture, appearance	-	Visual (comparison with a sample of new grease)	Free from any visible contaminations and moisture, smooth, minor colour changes perm.)
3	Cleanness, solid foreign substances	mg/kg	DIN 57813 Part 1	<= 10
4	Chemical characteristics	-	IR-test	According to standard sample

If a value has exceeded or fallen below the limit value, the result is negative. The anti-friction bearings must then be greased anew.

6.9.3 Anti-friction bearing

The new usability is assessed in accordance with the limit values of the defects listed in table 3:

Table 3 - Checking of anti-friction bearing and limit values

No.	*Type of defect*	*Unit*	*Checking method*	*Limit value*
1	Rust information	Degree of corrosion	Evaluation to DIN 51802 Section 10	0 (no corrosion)
2	Frictional corrosion	-	Visual	No chatter marks (brinelling)

If one of the limit values is exceeded, the anti-friction bearings must be replaced.

6.9.4 Bearing seal

Depending on the degree of protection of the motors, the bearings are sealed at the shaft through-hole in the following manner:

a) Diaphragm gland
b) Diaphragm gland with lubrication groove
c) Axial packing ring
d) Radial shaft packing ring
e) Any combination of a) to d)

Usability is to be assessed according to the following criteria:

- Lubrication groove must be filled with usable grease.
- The elestomer of the packing rings must not be rigid, brittle nor cracked.

If these requirements are not fulfilled, the grease or the packing rings must be replaced.

6.10 Terminal box

Upon delivery of the motors, the terminal box corresponds at least with degree of protection IP 55 (protection against harmful dust deposits and protection against water jets). Unproper transportation or storage may lead

to a decrease in this degree of protection. When "checking the winding" as described in paragraph 6.8, the terminal box must be especially checked for the following quality characteristics:

- The interior must be dry, clean and free from any dust deposits.
- No corrosion on the connecting and mounting elements.
- Sealing of the joints must be in proper condition.
- Rubber seals must not be rigid, brittle or cracked.
  Metal sealing surfaces must be bare and greased.
- Inlet openings must be tightly sealed.

If these requirements are not fulfilled, cleaning or replacement must be performed.

6.11 Coat of paint

Condition of the paint coat is assessed according to the limit values of the defects listed in table 4:

Table 4 - Checking of coat of paint and limit values

No.	*Type of defect*	*Unit*	*Checking method*	*Limit value*
1	Damage		Visual	None
2	Break-through of rust	Degree of rusting	DIN 53210	RI 0 (Stainless condition)
3	Change in the colour shade Dimmed, chalked	-	Visual comparison Colour Index RAL 840 HR	No significant difference

If the limit values are not adhered to, the defects must be eliminated, depending on type and degree of defect, according to the manufacturer's painting specification as follows:

- Touch-up in the case of any damage
- New application of coat of paint in the case of rust break-through, with preceding sandblasting Sa 2.5 according to DIN 55928 T4 (SIS 055900)
- Application of new top coat in the case of a change in colour shade.

7. SURFACE TREATMENT OF MOTORS

7.1 Cast Iron Motors

The surface treatment of cast iron motors is in accordance with the following:

7.1.1 Stator frame and bearing end shields

Coating system:		SFS 5225 E 70/2 - FeSa 2.5 NCS 4822-B 05 G or equivalent accepted by Company
Pretreatment:		SFS-ISO 8501-1 : 1990 (SS 05 59 00) or equivalent accepted by Company Sa 2.5 Very thorough blast cleaning.
Painting:	1	Two-pack polyamide cured epoxy primer 40 myM
	2-4	Two-pack polyamide cured epoxy finish 3 layers à appr. 50 myM approx 150 myM
		Nominal thickness min.: 180 myM

7.1.2 Fan cover

Coating system:		SFS 5225 EP 70/1 - FeFo NCS 4822-B 05 G or equivalent accepted by Company
Pretreatment:		ISO 9717 : 1990 Znph r 3 n Zinc phosphating 3g/m2
Coating:	1a)	Epoxy polyester powder paint primer 70 myM
	or	
	1b)	Epoxy polyester paint primer 70 myM
	2-4	Two-pack polyamids cured epoxy finish 3 layers à appr. 50 myM approx 150 myM
		Nominal thickness min.: 180 myM
Colour:		SS 019102 NCS 4822 - B 05 G, blue Munsell SB 4.5/3.25

8. PAINTING REPAIR INSTRUCTIONS (CAST IRON MOTORS)

8.1 Measuring the condition of the painting

The general principles of the condition of painted surface are explained in the standard SFS 3762 (ISO 4628). There are 6 classes; 0 ... 5, where 0 means free of defects and 5 means such a condition that no more classification is needed.

Degree of rusting	Rusted Area
Ri 0	0%
Ri 1	0,05%
Ri 2	0,5%
Ri 3	1%
Ri 4	8%
Ri 5	40-50%

8.2 The proper moment for painting

Painting will be done either as spot painting or as repainting. Repair painting will be done as spot painting when the degree of rusting is Ri 2 ... 3. The grease, dirt and salt will be removed from the surface with an alkaline, emulsion or solvent degreasing wash. After the alkaline or emulsion wash the surfaces will be rinsed thoroughly with water.

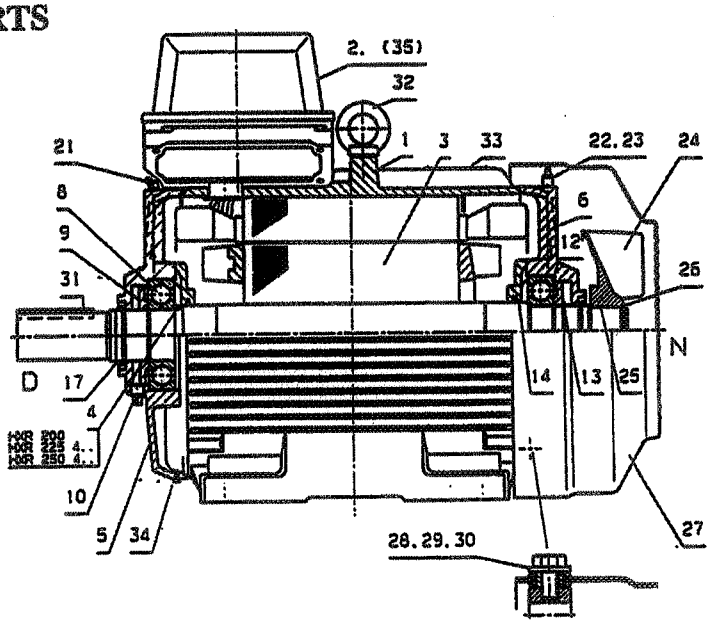
The peeling paint and rust scale will be removed from the spots to be painted to the grade Sa 2 1/2 either by scraping up and wire brushing or by a spray washer. The border between the purified spot and the solid spot will be mitred. By spraywashing one must be careful not to break the solid coat of paint. Purifying must be done in the correct direction and with the correct cleansing material.

The spots will be painted according to the paint explained in the enclosed schedule "Surface treatment of motors" to the original thickness of the coat.

When a uniform appearance is required the whole surface will be painted with the finish paint. The old, solid coat of paint must be handled so that the new paint will stick to it (the surfaces will be cleaned with a suitable solvent degreasing wash and abraded mat when necessary).

The repair painting will be done as a repainting when the degree of rusting is Ri 4. Then the paint and rust will be spraywashed from the whole surface and the painting will be performed according to the schedule "Surface treatment of motors".

9. SPAREPARTS



1	Stator, complete	13	Locking ring
2	Stator terminals	14/20	Inner bearing cover with screws
3	Rotor with shaft	17	V-ring D-end + N-end
4	Ring	21/22	Grease nipple D-end + N-end
5/7	Endshield D-end with screws	23	Nipple extension
6/7	Endshield N-end with screws	24	Fan
8	Bearing D-end + N-end	25	Tolerance sleeve
9	Valve disc. D-end + N-end	26	Retaining ring
10	Scaling plug	27	Fan cover
11	Nave spring washer	28-30	Rubber bushing with screw
		31	Key

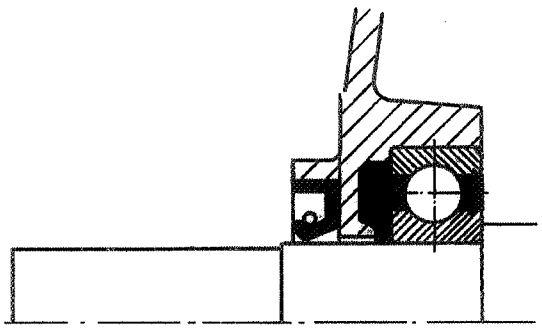
SPECIFICATION OF SPARE PARTS REQUIRED:

- **Motor type**
- **Motor no.**
- **Part no.**

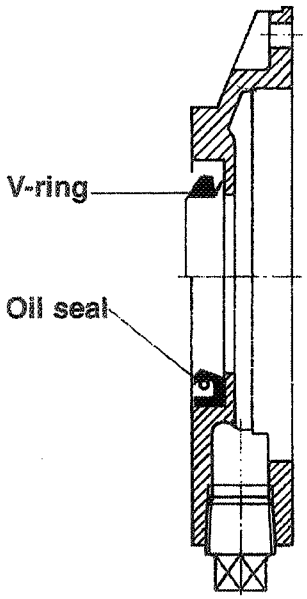
More Thought in the Making

ADDITIONAL SEALING

All motors have provision for a radial sealing ring in the D-end, as standard.



IEC 160

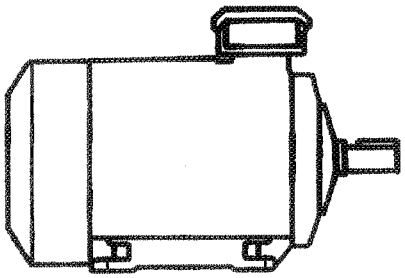


IEC 180...400

High Efficiency Saves Energy

Total costs of a motor: 1% Purchase price
99% Operating costs

Input power P1 = $\frac{P2}{Eff} \times 100$



Iron

Resistance

Output power P2

Friction

Operating costs can be affected by selecting a motor with high efficiency.

Hamworthy Moss AS

Part no: M5905-001txt

TG:Item:110

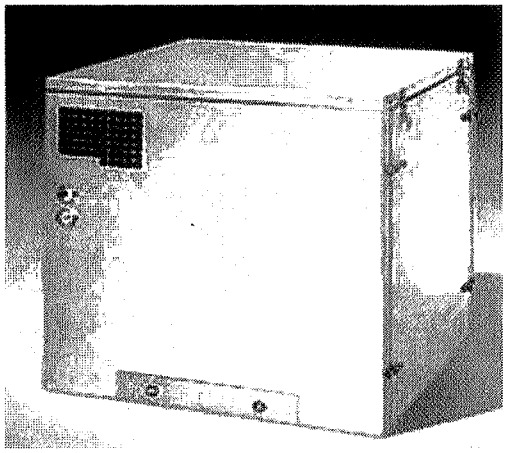
Rev: 01

Date: 20050608

ROOTS BLOWER

LRB45/2PB

Operating instructions



Dear customer

Thank you for purchasing a Robuschi blower from HamworthyKSE as we appreciate your trust. You are strongly recommended to take the following preliminary actions.

1. The instructions given in this manual must be strictly followed prior to positioning and operating the machine. Observe specially the statements by the following symbols

Warning: Signals the risk of serious physical dangers to people and/or serious danger to ROBOX.

Note : Signals important statement for the operation of ROBOX.

besides any possible recommendation given in our order confirmation.

2. The maintenance operations are to be carried out exactly as described in this manual.
3. The safety regulations are to be fully complied as indicated in this manual.
4. The operators and the personnel in charge must be well acquainted with reported instructions, which must be avaiable to them whenever required.
5. **The use of ROBOX must be only as described in the operating manual.**

Robuschi & C. S.p.A. and HamworthyKSE will not be liable for any damage, breakdown, injury deriving from the nonpursuance of the instructions and directives stated in this Manual.

The type of the blower and its serial number are to be quoted whenever additional information are requested. The serial number is pinted on the nameplate fixed to the machine.

The rights of this Manual are reserved to Robuschi & C. S.p.A.. Total or partial reproduction of this manual is permitted only with Robuschi written authorization.

Warning: This manual has always to be consulted together with the operating and maintenance instruction for blower.

Safety regulations

Warning: All the personnel that may come in contact with the blower must observe safety regulations in order to avoid phisical injuries.

ROBOX in operation

- Do not touch external surfaces of the blower and of the outlet silencer: burns danger.
- If ROBOX is operating disconnected from the piping system, place a screen in front of the inlet and keep away from the blower outlet flow.
- Do not open oil plugs during operation.
- Do not disassemble transmission guard.
- Do not approach ROBOX without suitable clothing (avoid large clothes, neckties, bracelets or necklaces).
- Avoid exposure to the noise produced by ROBOX L (without sound enclosure) without wearing suitable noice protection

- Do not use ROBOX in operating conditions different from the ones rated in the order confirmation.
- Do not touch components under electric supply.
- Dispose of fire-fighting equipment close unit

Before any staff service of ROBOX

- Stop ROBOX and the auxiliary systems.
- Insulate ROBOX from the plant and restore the atmospheric pressure into it.

Warning : The gas contained in the blower may be hot, toxic and irritant.

- Wait until ROBOX returns at ambient temperature.
- Disconnect all power supplies and electrical cables from the unit.
- Disconnect the main and auxiliary piping.

During staff serviceof ROBOX

- Check that all the operations indicated above have been completed.
- Lift ROBOX and the main piping by a suitable equipment only.

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1 ROBOX CHARACTERISTICS

1.2 General description

ROBOX is a blower compact unit driven by an electric motor, complete with silencers and with all accesories for installation and operation and, on request, with noise enclosure.

ROBOX is identified by:

1.4 ROBOX L

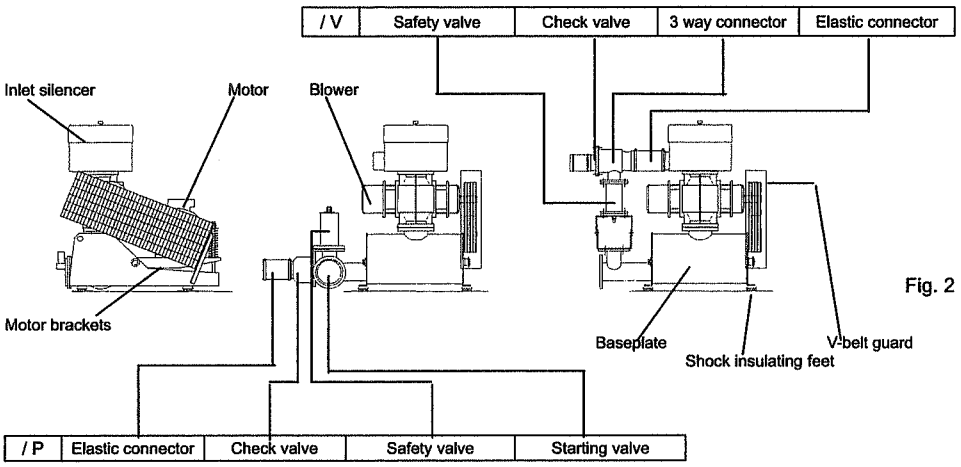


Fig. 2

2 PERFORMANCE LIMITS AND WORKING CONDITIONS

2.1 Conveyed gas

Air, nitrogen or gases compatible with the materials of blower and other ROBOX components and with lubricating oil.

Warning: ROBOX is not suitable to convey explosive, toxic or dangerous gases.

Warning: The suction of liquids damage the blower.

2.2 Performance limits

Size	RPM		P1 mbar		P2-P1 mbar	P2/P1	T1 C		T2 C	T2-T1 C
	MAX	MIN (1)	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MAX
15	4700	1200	P0+50	P0-500	800	2	35	-25	150	110
25					600					90
35	4800	1000	P0+100	P0-500	1000	2	50	-25	150	130
45					1000					110
46					700					90
55	4800	900	P0+100	P0-500	1000	2	50	-25	150	130
65					1000					110
66					700					90
75	3800	700	P0+100	P0-500	1000	2	50	-25	150 (2)	130
85					1000					110
86					700					90
95	3000	550	P0+100	P0-500	1000	2	50	-25	150 (2)	130
105					1000					110
106					700					90

Size	RPM		P1 mbar		P2-P1 mbar	P2/P1	T1 C		T2 C	T2-T1 C
	MAX	MIN (1)	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MAX
115	2400	450	P0+100	P0-500	1000	2	50	-25	150 (2)	130
125					1000					110
126					700					90
135	1800	350	P0+100	P0-500	1000	2	50	-25	150 (2)	130
145					1000					110
155					700					90

P0 Atmospheric pressure
P1 Blower inlet absolute pressure
P2 Blower outlet absolute pressure
(1) Resonance phenomena in the plant are possible when speed of rotation is close to the minimum one

(2) 160 C for blowers /R-F

T1 Blower inlet temperature

T2 Blower outlet temperature

2.3 Flow adjustment

- Change transmission ratio
- Change frequency of the motor
- Use a two speed motor
- Discharge excess flow and silence it

Warning: Do not recirculate flow to ROBOX inlet.

Warning: Do not adjust flow by throttling inlet or outlet pipe.

2.4 Noise level

Noise level of ROBOX is confirmed in order acknowledgement and in selection catalogue together with operation data.

For different operating conditions contact ROBUSCHI or an authorised distributor.

Warning : For high compression ratio and for high speed of rotation noise level of ROBOX L (without noise enclosure) can be higher than 85 dB(A).

3 STORAGE

3.1 Unpacking

Check always the correspondence between documents and materials and the presence of eventual damages due to transport.

Warning: Remove with care the packing and clearing all the dangerous elements (nails, splits, etc..)

3.2 Handling

Warning: Do not remove arrangement to lock motor brackets during handling.

3.2.2 ROBOX L

Use the wooden pallet of ROBOX L or use hoist scrapes as indicated in figure 4.

Fig. 4

3.3 Preservation

Keep ROBOX in a place protected against solar radiation and at following climatic conditions :

Temperature from -15 ×C to 40 ×C
Relative umidity from 20 % to 70 %

If different climatic conditions are forecast contact ROBUSCHI. Renew preservation every 12 months or more frequently if humidity is higer than 60%, following the Operating and Maintenance instructions for blowers.

4 INSTALLATION

4.1 Lay out

To determine the dimension and weigth of ROBOX see the general drawings at page 32 and 33. Basement has to be flat and level (max 0.5 mm on 1 m), free from vibrations and suitable to support the weigth of unit, no dynamic loads are involved. Figure 5 shown the recommended lay-out for one or more ROBOX inside a chamber and the minimum dimensions for installation and for maintenance of ROBOX.

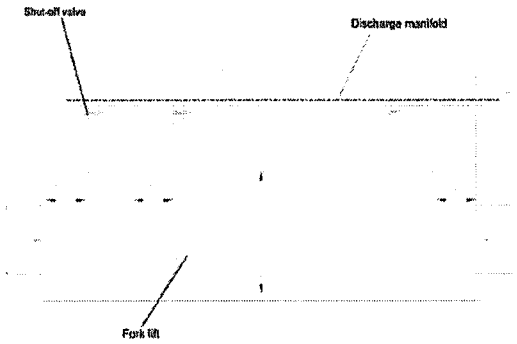


Fig. 5

The doors or the openings of the ROBOX room must be suitable for the passage of the fork lift. The dimension L must allow the movement of the fork lift during the on-site positioning of ROBOX.

Note : To fix ROBOX on metallic frame contact ROBUSCHI or an authorized distributor.

The diameter of the terminal pipe must be egual to the terminal pipe of ROBOX indicated in the drawings at page 32 and 33. Install always a shut-off valve on the terminal pipes of the plant The diameter of the discharge manifold must be choosen in order to obtain an average gas speed < 30 m/s

4.2.2 ROBOX L

Transport ROBOX L on site of installation as indicated in par. 3.2.2. Slide the elastic connector on the terminal pipe of the plant as indicated in par 4.5. Position ROBOX L as indicated at par. 4.5 Fix ROBOX L by means of bolt anchor (Fig. 7)

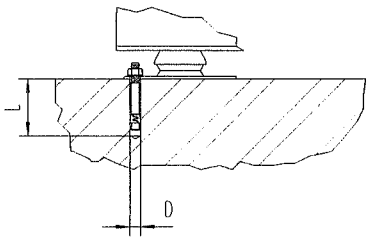


Fig. 7

ROBOX	Bolt anchor	Q.ty	Floor drilling	
			D mm	L mm
1	8 x 71	8	8	65
2	8 x 71	8	8	65
3	8 x 71	8	8	65
4	12 x 112	8	12	105
5	12 x 112	16	12	105

4.3 Indoor installation

Check the ventilation following one of the figures recommended in Fig. 8. The total flow Qa (m3/h) incoming in the blower local is the sum of the suction flows of the blowers operating simultaneously. The total ventilation flow Qv (m3/h) is calculated from the sum No (kW) of the motors operating simultaneously in the local following this relation :

Qv = 30 x No

The air speed on the local openings must be < 1 m/s for natural ventilation and it must be < 4 m/s for forced ventilation.

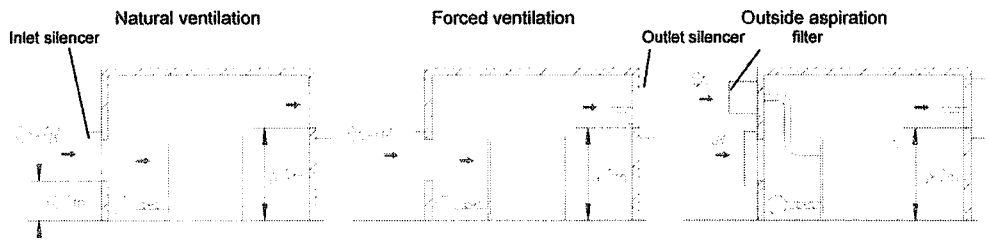


Fig. 8

4.5 Pipe-lines

Provide terminal pipes of the plant following the dimensions indicated in the drawings at page 32 and 33. Insert the elastic connectors and relevant hose clamps on the terminal pipes as indicated in figure 9.

ROBOX	1	2	3	4	5
L	200	200	230	230	300

Position ROBOX terminal pipeat the distance indicated in Fig. 9.2

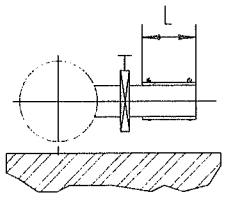


Fig 9.1

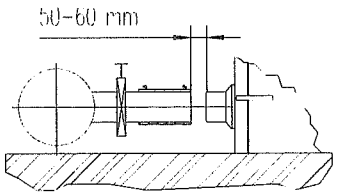
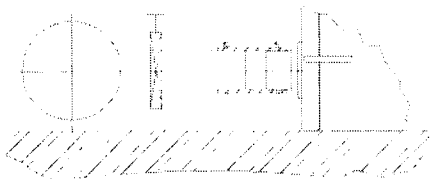


Fig 9.2

Position the elastic connectors in the final position and fasten the hose clamps as indicated in Fig. 9.3



4.6 Electrical connections

Electric connections must be set up by authorized specialists in compliance with regulations applying to the place of installation and in accordance with the requirements of the Body supplying electrical energy.

Note : Robuschi & C. S.p.A. refuses all responsibility for electric connection not complying with the law in force.

Check on the motor plate : Voltage, Absorbed current, Frequency, number of phases. Wiring diagram accompanies the terminal board of the motor , if the diagram has not been supplied request it from the motor manufacturer. Use suitable electric cables depending on the nominal current of the electric motor. Keep the electric cables away from heat sources and/or pointed edges An electric star/delta connection diagram is shown at page 34. Protect the motor by means of automatic switch set at the rated value of the motor current . For the safety of personnel the system must be protected by a suitable grounding device.

Warning : Blower service must be carried out after disconnecting the electrical supply.

5.1 Preliminary controls

- Remove arrangement used to lock motor brackets during transport.
- Check correct positioning of V-belts
- Check the efficiency of safety devices
- Fill both blower sumps with lubricating oil (see
- Operating and maintenance instructions blowers)

5.2 First start up

Warning : The personnel must wear the noise protection devices.

Check direction of rotation of the blower by means of a short current pulse.

Warning : Do not rotate the blower in the wrong direction for more than a few revolutions.

- Check direction of rotation of the fan, it must be counterclockwise seen from the motor. Open the valve of the cooling circuit (only for -RV)
- Start-up ROBOX.
- Increase the operating pressure gradually until the rated value is reached.
- Set safety valve according to par. 5.4.
- During the first 8 hours of operation check that there are no strange noises, vibrations, oil leackages or overheating, if such problems are found stop ROBOX immediately and contact our PV service.

5.3 Operation

Start ROBOX and check what enlisted in the table below.

Check	Parameter	Frequency				Note
		h	G	S	M	
Visual	Pressure		1			ROBOX in operation
	Temperature		1			
	Absorbed power		1			
	Cooling liquid flow		1			
	Noise		1			
Lubrification	Oil level	500				ROBOX out of operation
	Oil leakages			1		
	Viscosity	500				
	Oil change	4000			6	
Filter	Vakuum		1			< 35 mbar
	Clogging				2	
Transmission	Wear	2000				ROBOX out of operation
	Belt tension	2000				
	Belt change	15000			24	

h operation hours S weeks
G days M months

Note : in case of double indication follow the most limiting one for the application

5.4 Stopping the ROBOX

Remove, if possible, the differential pressure.

Note : ROBOX can also be stopped in the presence of the counter-pressure, but, because the high current absorption of the motor, problems with the electric circuit may occur.

Stop electric supply

Warning : Check that the deceleration of ROBOX is even and without vibrations.

5.7 Silencer setting

Silencers are set before delivery for the working conditions confirmed in order acknowledgement. Following setting operations are requested only by different working conditions.

Note : In case of variable speed operation set the silencers for the lowest speed.

5.7.1 Inlet silencer ROBOX 1-2-3

Unloose cover knob and remove silencer cover Position adjustable baffle at the new speed referring to the scale inside silencer. Position silencer cover.

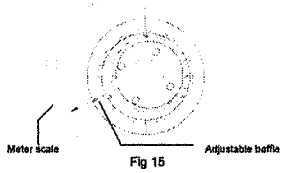


Fig 15

Loose pipe and hose clamps (Fig. 17). Adjust lenght L and position of the silencing pipe as given in the table. Tighten pipe and hose clamps.

RPM	Dimension L (mm)			
	ROBOX 1	ROBOX 2-3	ROBOX 4	ROBOX 5
750	A 560	A 540	A 1040	A 1285
1000			A 940	A 965
1250			A 770	B 1295
1500			B 1040	B 1160
1750			B 950	B 1070
2000			B 900	B 1000
2250			B 850	B 960
2500		B 730	B 800	
2750		B 690	B 750	
3000		B 645		
3500	A 500	B 600		
4000	B 560	B 560		
5000	B 560	B 520		

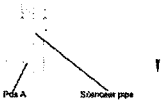


Fig. 17

6 MAINTENANCE

Warning : Before any service operation stop ROBOX following the procedure indicated in the safety regulations at page 3 of this manual.

6.1 Oil change

Change lubricating oil as per Operating and maintenance instructions for blowers.

Warning : Dispose the used oil in accordance with local regulations

6.2 Filter replacement

6.2.1 ROBOX 1-2-3

Unloose cover knob of inlet silencer and remove cover. Replace filter element. Position silencer cover and tighten cover knob.

6.3 V-belts and/or pulleys replacement

Warning : This operation must be carried out only after disconnecting electric supply.

- Disassemble V-belt guard (Fig. 21).
- Release spring of V-belt tightening device.
- Lift the motor a few degrees toward blower and secure it in this position by means of wooden supports under motor brackets (Fig. 22).
- Replace V-belts Replace pulleys if necessary.
- Align pulleys by moving motor crosswise along motor brackets pivot (Fig. 23).
- Remove wooden supports under motor brackets and tension V-belts by compressing the spring around half of its set.

6.4 Motor replacement

Warning : This operation must be carried out only after disconnecting the electric supply

- Dissasemble V-belts as descibed in par. 6.3
- Disassemble motor pulley
- Unscrew fixing bolts of motor
- Replace motor
- Fix new motor on motor brackets and check its alignment with motor brackets pivot.
- Reassemble motor pulley
- Align pulleys by moving motor crosswise along motor brackets pivot (Fig. 23)
- Reassemble as describe in par. 6.3

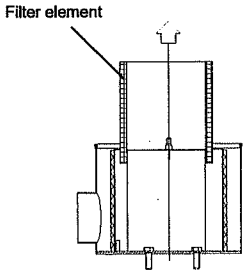


Fig. 18

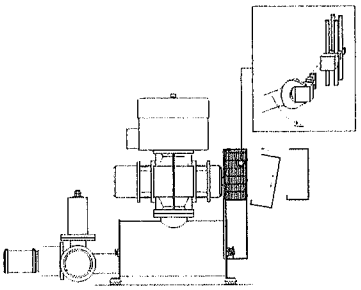


Fig. 21

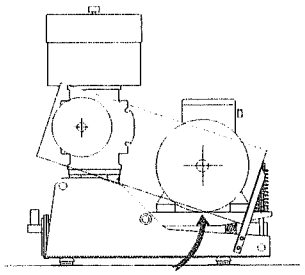


Fig. 22

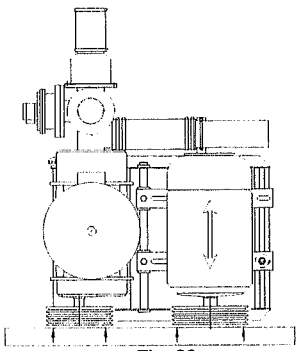


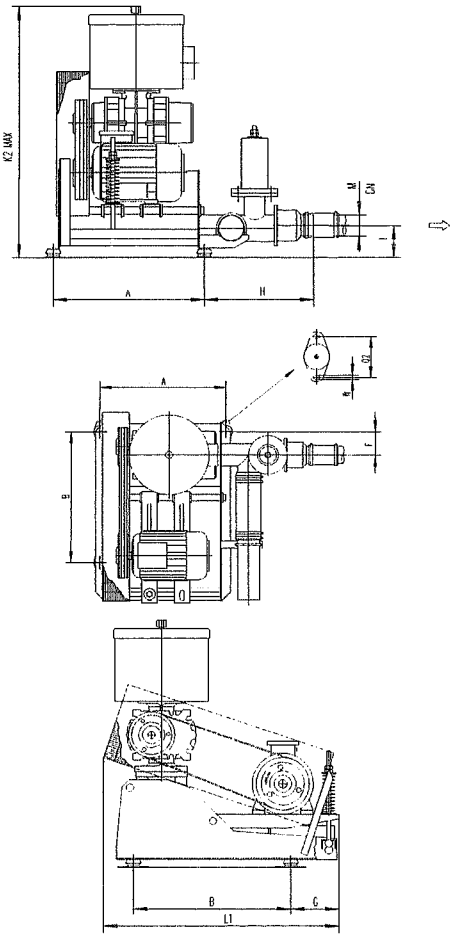
Fig. 23

Operating problems	List of causes
The motor does not start up and there is no noise	1-3-4
The motor does not start up, but humming noise heard	2-3-4-5
Automatic cut off just after start up	3-4-5-6-7-8
Inlet pressure different from the rated value	6-7
Capacity zero **STOP ROBOX IMMEDIATELY**	6-7-10-11-13-14-15
Outlet pressure different from the rated value **STOP ROBOX IMMEDIATELY**	5-6-7-8-9
Outlet temperature different from the rated value **STOP ROBOX IMMEDIATELY**	8-12-13-15-16
High absorbed power	3-5-6-7-8-9-10-11-12-13-14-15
Oil and/or liquid leakages	5-16
High oil temperature	6-7-8-11-16
Unusual noises and/or vibrations **STOP ROBOX IMMEDIATELY** 5-17-18	5-17-18
Safety valve does not close	8-9-10-13-14
Start valve does not close	19-20-21

	Cause	Solution	Rif.
1	At least 2 of electric connections have been cut off	Check the fuses, terminal boards and connection cables and if required replace them	4.6
2	1 electric connection has been cut off	See point 1	4.6
3	Incorrect electric connection	Check electric system	4.6
4	Faulty motor	Check the electric motor	4.6
5	Blower prblems	Check the blower	(1)
6	Filter clogged	Clean or replace it	6.2
7	Suction pipe clogged (only /C)	Clean it	(2)
8	Dscharge pipe clogged	Clean it	(2)
9	Shut-off valve closed	Open it	
10	Check valve positioned in wrong direction	Correct it	
11	Wrong safety valve setting	Reset it	5.5
12	Small pipe line section	Increase it	4.1
13	Wrong traansmission ratio	Correct it	6.3
14	V-belts drive	Check V-belts tension / replace V-belts	6.3
15	Wrong direction of rotation	Correct it	5.2
16	High oil level	Correct it	6.1
17	Motor securing	Fix it	6.4
18	ROBOX securing	Fix it	4.2 4.3
19	No counterpressure		
20	Faulty diaphragm	Replace it	
21	Diaphragm chamber leaking	Make it air tight	

(1) For these operation see Operation and maintenance instructions for blowers
(2) Check the plant

8.2 ROBOX L overall dimensions



ROBOX	1	2	3
A	438	650	925
B	515	760	1120
F	75	120	193
G	75	125	130
H	315	498	660
I	117	140	180
L1	692	1010	1405
M	76.1	114.3	170
DN	65	100	150
K2	785	1122	1600
Q2	88	110	124
W	10	11	10
Massa Weight (kg)	80	305	635

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8.2.2 Reassembly of gear side sump

1 BLOWER CHARACTERISTICS

1.2 Operating principle

RBS series blowers are positive displacement blowers comprising two conjugate shaped rotors 2 which rotate inside a figure 8 shaped body 1. The gas enters the blower at pressure P_1 and temperature T_1, it is trapped in the volume V and finally discharged from the outlet at pressure P_2 and temperature T_2. The capacity is proportional to the speed of rotation and is almost constant when the operating pressure varies.

P1 inlet absolute pressure
T1 inlet temperature
P2 outlet absolute pressure
T2 outlet temperature

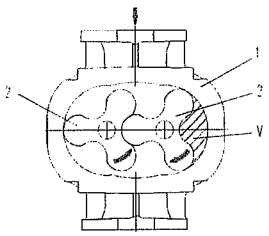


Fig.1

1.2 Construction

The body 1 is closed at both ends by covers 5A and 5B in which the seals 45 and bearings 31, 32 and 33 are located. The rotors 2 are synchronised by means of a gear with involute toothed wheels 11A and 11B. The shafts have labyrinth seals, gas leaks are collected into special air spaces in the covers and are discharged into the atmosphere. Two sumps 12A and 12B are mounted on the covers which act as oil tanks for the bath lubrication of the bearings and of the synchronised gear .

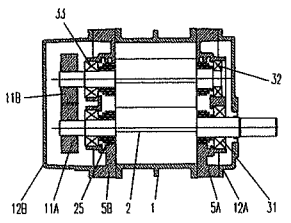


Fig. 2

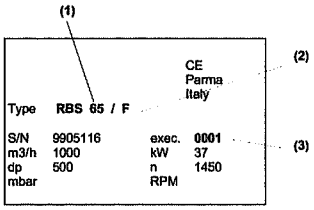
1.3 Nameplate

-Blower type

1. Size from 55 to 225
2. Version
   F Flanged
   V Vertical
   H Horizontal
   SP Without feet
   RV Cooled vertical
3. Execution 0001

- S/N Serial number
- m3/h Capacity
- kW Power
- dp mbar Differential pressure
- n RPM Rotation speed

Note: For a detailed description of the blower materials and all its components see also the catalogue or consult our technical service.



3 STORAGE

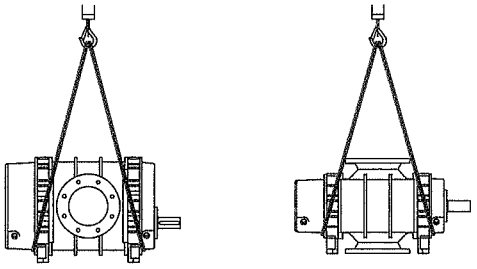
3.1 Unpacking

Check always the correspondence between documents and materials and the presence of eventual damages due to transport.

Warning: Remove with care the packing and clearing all the dangerous elements (nails, splits, etc...)

Soffiatore	kg
35	85
45	97
46	107
55	144
65	159
66	190
75	220
85	250
86	310
95	350
105	400

Soffiatore	kg
106	450
115	565
125	610
126	710
135	976
145	1099
155	1199
165	1850
175	1950
205	2950
225	3350



⚠ Warning: Do not use the holes in the flanges to lift the blower

Fig. 3

3.3 Preservation

Keep the blower in a dry, cool, closed environment, do not remove the openings protective covers and renew the preservation (see 3.3.1 and 3.3.2) every 6 months or more frequently if the climate is damp.

3.3.1 Bearing preservation

Fill the sumps with anti-rust oil till the sight glass and rotate manually the blower shaft . Dispose the used oil in accordance with local regulations.

3.3.2 Compression chamber preservation

Remove the protective coverings from the blower openings and apply a thin film of anti-rust oil to the internal surfaces of the body, of the covers and of the rotor surfaces.

Parts	Anti-rust oil	
	Type	Trade
Shiny external parts	Rustia 27 Rust Ban 397 V-Produkt 9703	AGIP ESSO SHELL
Gear and bearings	Rustia C 100 Antiruggine MZ 110 Ensis Motor Oil 20	AGIP ESSO SHELL
Compression chamber	Rustia C 100 Antiruggine MZ 45 Ensis Motor Oil	AGIP ESSO SHELL

4 INSTALLATION

4.1 On-site positioning of blower

The blower has to be set horizontally on a level surface and attached using screws which secure the feet or the outlet flange (/F e /SP version).

4.2 Changing the inlet/outlet arrangement (from size 35 to 155 only)

To move from the arrangement with inlet and outlet on a vertical axis to that with inlet and outlet on an horizontal axis and viceversa exchange the oil levels by changing the position of the plugs in accordance with Fig. 4 on both blower sumps.

Pos	Description
Ps	Left foot
Pd	Right foot
Tc	Oil fill plug
Ts	Oil drain plug
T	Olugs
L	Oil level plugs

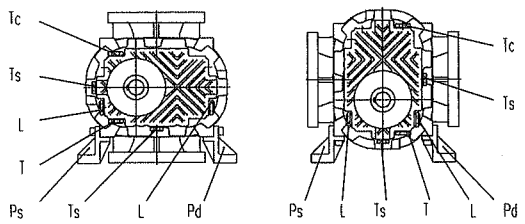


Fig. 4

4.3 Direction of rotation - Gas flow direction

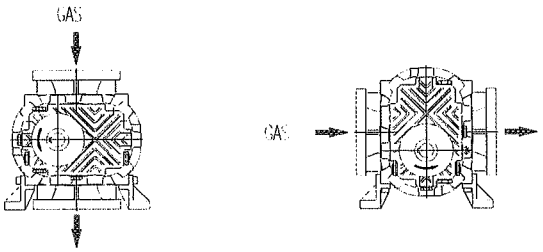


Fig. 5

Warning: Do not use the blower with a direction of rotation or a flow direction different from that one shown in Fig 5.

4.4 Coupling

4.4.1 Direct coupling

Slide the half couplings onto the shaft of the blower and of the motor using suitable tools.

Warning: Do not use a hammer to slide on the half couplings.

Secure the half couplings with security dowels which will push on the keys. Place the blower at the distance S from the motor as indicated in the table below. Align the shafts of the blower and of the motor by shims under the feet of the motor and/or blower. Check the alignment by using comparators or gauges with scales as shown in Fig. 6.

Coupling diameter	Distance S (mm)	Axial deviation Ka (mm)	Standard deviation	
			Radial Kr (mm)	Angular Kw (mm)
80	3	1	0,13	0,13
100	3	1	0,15	0,15
130	3	1	0,18	0,18
150	3	1	0,21	0,21
160	4	2	0,27	0,27
180	4	2	0,30	0,30
200	4	2	0,34	0,34
225	4	2	0,38	0,38
250	5,5	2,5	0,42	0,42
280	5,5	2,5	0,47	0,47
315	5,5	2,5	0,52	0,52
350	5,5	2,5	0,58	0,58

Alignment check

$S_{max} < S + Ka$

$S_{min} < S - Ka$

$$Kv = 1.5 \frac{rpm}{3000}$$

$Dr < Kr \times Kv$

$Dw < S_{max} - S_{min}$

$Dw < Kw \times Kr$

$Dr + Dw < Kw \times Kv$

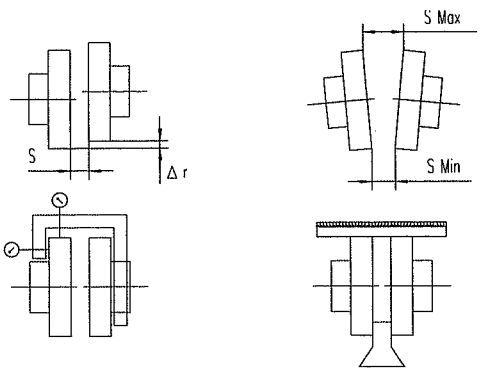


Fig. 6

Warning: Alignment errors cause premature wearing of the bearings and flexible couplings.

4.4.2 Belt drive coupling

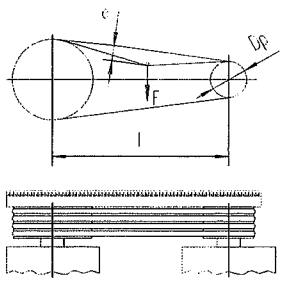
Use suitable equipment to mount the pulleys onto the blower and motor shafts. The minimum allowed blower pulley pitch diameters are shown in the table attached below.

Size	Differential pressure (bar)										
	200	300	400	500	600	700	800	900	1000	1100	1200
35	80	80	80	80	80	90	100	106	112	118	125
45	80	80	80	90	100	106	112	118	125		
46	90	100	106	112	118	125					
55	80	80	80	80	80	90	100	106	112	118	125
65	80	80	80	90	100	106	112	118	125		
66	90	100	106	112	118	125					
75	80	90	100	106	112	118	125	132	140	150	160
85	100	106	112	118	125	132	140	150	160		
86	118	125	132	140	150	160					
95	100	106	112	118	125	132	140	150	160	180	200
105	112	118	125	132	140	150	160	180	200		
106	132	140	150	160	180	200					
115	106	112	118	125	132	140	150	160	180	200	225
125	118	125	132	140	150	160	180	200	225		
126	140	150	160	180	200	225					
135	112	118	125	132	140	150	160	180	200	225	250
145	125	132	140	150	160	180	200	225	250		
155	150	160	180	200	225	250					
165	150	160	180	200	225	250	280	300	325	350	400
175	180	200	225	250	280	300	325	350	400		
205	200	225	250	280	300	325	350	400	450		
225	280	300	325	350	400	450					

Warning: Do not use a hammer to mount the pulleys.

Mount the drive belts. Produce belt tension by using the motor thrust screws in accordance with the values shown in the table.

Belt profile	Force F (daN)	Diameter D of smaller pulley (mm)	Deflection E (mm)
SPZ XPZ	2.5	95 - 125 > 132	1.45 1.30
SPA XPA	5.0	100 - 140 150 - 200 >224	2.30 2.10 2.00
SPB XPB	7.5	160 - 224 236 - 355 >375	1.55 1.20 1.10
SPC XPC	12.5	250 - 355 375 - 560	1.80 1.60



e = l X E / 100

Fig. 7

Warning: Excessive belt tension could damage the blower and the motor.

During this phase check the alignment of the pulley by using a scale as per Fig. 7. Secure the feet of the motor

4.5 System piping

The diameters of the system piping must be chosen in order to obtain an average gas speeds from 15 a 30 m/s and must never be smaller than the diameters of the blower openings, if the diameters are different, use a taper connector. The system piping should be properly aligned and supported to prevent stress on the blower openings. Provide flexible joints. The pipes must be thoroughly cleaned before connection. The gaskets must not interfere with the gas system.

Warning: Remove the protective covers from the blower openings just before connection.

4.5.1 Inlet pipe

Connect a silencer directly to the inlet of the blower. Clean the pipe thoroughly. If necessary install a dirt filter for the first 100 working hours and provide a vacuometer to check the dirt filter. Support the pipe.

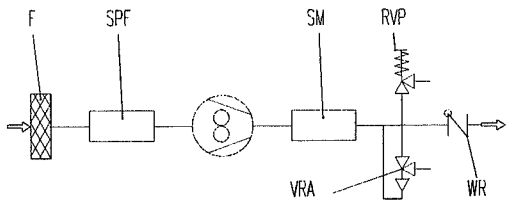
4.5.2 Outlet pipe

Connect a silencer directly to the outlet of the blower. Support the piping at the point nearest to the flexible coupling. Insulate the pipes to avoid heating the environment as well as a precaution to accidental contact.

4.6 Accessories

4.6.1 Pressure operation

Pos.	Description
F	Filter
SPF	Inlet silencer
SM	Outlet silencer
RVP	Safety valve
WR	Check valve
VRA	Starting valve



5 OPERATION

5.1 Preliminary controls

- If the blower has been in storage for more than 6 months, check its state of preservation.
- Check the alignment of the transmission and eventually the belt tension .
- Check that the blower rotate freely by hand.
- Check that the safety protection devices have been correctly installed and secured.
- Check that the pipes have been internally cleaned and if eventually obstructions have been removed.
- Check that all connections between pipes and blower are tightened and sealed.
- Fill the blower with oil as described in paragraph 6.1

5.2 First start up

Warning: The personnel must wearn the noise protection devices.

- Open the shut-off valve.
- Check that the safety valve has been set at the operating value.
- Check the rotation direction using a short current pulse.

Warning: Do not rotate the blower in the wrong direction for more than a few revolution.

- Start the blower.
- Increase the operating pressure gradually until the rated value is reached.
- During the first 8 hours of operation check that there are no oil leackages, and strange noises or vibrations, if such problems are found stop the blower immediately and contact our PV service.

5.3 Operation

Start the blower and check what enlisted in the table below.

CHECK	PARAMETER	FREQUENCY				NOTE
		h	G	S	M	
VISUAL	Pressure		1			Blower in operation
	Temperature		1			
	Absorbed power		1			
	Cooling liquid flow		1			
	Noise		1			
LUBRIFI-CATION	Oil level	500				Blower out of operation
	Oil leakages			1		
	Viscosity	500				
	Oil change	4000			6	
FILTER	Vakuum		1			< 35 mbar
	Clogging				2	
TRANS-MISSION	Wear	2000				Blower out of operation
	Belt tension	2000				
	Belt change	15000			24	

h operating hours
G days
S weeks
M months

Note: In case of double indication follow the most limiting one for the application.

5.4 Stopping the blower

Remove, if possible, the differential pressure.

Note: The blower can also be stopped in the presence of the counter-pressure, but, because the high current absorption of the motor, problems with the electric circuit may occur.

Stop electric supply

Warning: Check that the deceleration of the blower is even and without vibrations.

6 MAINTENANCE

Warning: Before performing any maintenance operation, stop the blower by following the procedure described at page 3 of the present manual.

6.1 Oil change

The first oil change is performed after 500 working hours, further changes as per table in the paragraph 5.3

Warning: Dispose the used oil in accordance with local regulations.

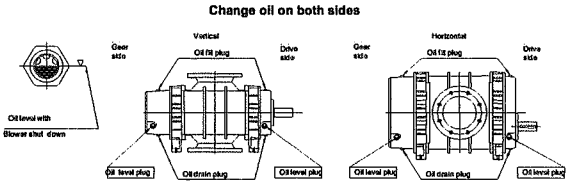


Fig. 9

Oil quantity (lt) for /F /SP /V /RV

Oil quantity (lt) for /H

Size	Oil quantity (lt) for /F /SP /V /RV			Oil quantity (lt) for /H		
	Gear side	Drive side	Total	Gear side	Drive side	Total
35-45-46	0.75	0.40	1.15	0.45	0.25	0.70
55-65-66	1.20	0.60	1.80	0.60	0.30	0.90
75-85-86	2.00	0.90	2.90	0.90	0.40	1.30
95-105-106	3.50	1.60	5.10	1.60	0.80	2.40
115-125-126	4.80	2.80	7.60	3.10	1.80	4.90
135-145-155	10.50	6.00	16.50	6.00	3.50	9.50
165-175	18.00	10.00	28.00			
205-225	30.00	16.00	46.00			

6.1.1 Oil type and viscosity

Mineral oil for general use, mineral oil for hydrostatic and hydrodynamic circuits, mineral oil for internal combustion engines or polialfaolefine base synthetic oil.

Warning: Do not use mineral oil with EP additives or silicon or diester base synthetic oils.

Oil type	Viscosity	Use			
		Tambient	T2	Toil	Note
Mineral	100	< 0	< 90	< 50	Check the poor point
Mineral	150	< 35	< 110	< 80	
Mineral	220	< 50	< 130	< 110	Installation in soundprroof enclosure
Synthetic	220	> 50	> 130	> 110	

6.1.2 Recommended mineral oils

Make	Type	ISO VG - 150	Poor point	ISO VG - 220	Poor point
AGIP	RADULA	150	-20	220	-18
BP	ENERGOL	CS 150	-12	CS 220	-12
ESSO	NUTO	150	-18	220	-18
MOBIL	D.T.E.	EXTRA-HEAVY	-9	BB	-7
SHELL	TELLUS	C 150	-18	C 220	-15

6.2 Extraordinary maintenance

Warning: Before performing any maintenance operation, stop the blower by following the procedure described at page 3 of the present manual.

For the identification of the parts see sections 273141, 270773 and 271110 at the end of this manual.

6.2.1 Replacing the shaft seal

- Disassemble the drive
- Empty the lubricating oil out of the sump 12A
- Disassemble the sump 12A
- Clean the housing of any residues and/or deposits.
- Replace the seal ring pos. 43
- Reassemble the sump 12A
- Refill the sump 12A with new lubricating oil as per paragraph 6.1.2

Warning: Dispose the used oil in accordance with local regulations

Couple the motor as shown in paragraph 4.4.1 o 4.4.2.

6.2.2 Cleaning of compression chamber

Clean the internal surface of the chamber and the surface of the rotors from any deposits and rust by using solvents and a scraper

Warning: Keep to prescribed safety rules when using solvents and wear protection glasses and safety gloves

Note: Do not damage the internal surface of the chamber and the surface of the rotors surface when using the scraper.

6.2.3 Check of the gear clearance

- Empty the lubricating oil out of the sump 12B
- Disassemble the gear sump 12B
- Measure the clearance between the gear teeth according to the attached table 264468 . In order to do this secure one of the gears and rotate the other until there is no contact.
- Reassemble the sump 12B
- Refill the sump 12B with new lubricating oil as shown in paragraph 6.1.2

Warning: Dispose the used oil in accordance with local regulations

Send the table 264468 filled out with measured clearances to ROBUSCHI & C. S.p.A. (or any authorised distributor) for their review.

6.2.4 Check of the rotors clearance

- Disassemble the inlet piping
- Insert gauges into the inlet opening to measure the clearance of the rotors in various positions, turning the drive shaft by hand according to the attached table 264468.

Warning: During this operation pay attention to rotors which can cause the squizing of the finger and hands.

- Reassemble the inlet piping together with the silencer if present
- Send the table filled out with measured clearance to ROBUSCHI & C. S.p.A. (or any authorised distributor) for their review.

7 TROUBLESHOOTING

Operating problems	List of causes
The motor does not start up and there is no noise	1-3-4
The motor does not start up, but humming noise is heard	2-3-4-5-6-7
Automatic cut off just after start up	3-4-5-6-7
Inlet pressure different from the rated value	13-16
Outlet pressure different from the rated value **STOP THE BLOWER IMMEDIATELY**	14-16
Outlet temperature different from the rated value **STOP THE BLOWER IMMEDIATELY**	8-13-14-16-17
High absorbed power	3-5-6-7-9-13-14-16-19
Oil and/or liquid leakages	10-11-12-15-19
High oil temperature	13-14-16-17-18-19-21
Unusual noises and/or vibrations **STOP THE BLOWER IMMEDIATELY**	5-6-7-8-9-13-14-17-22

	Cause	Solution	Rif.
1	At least 2 of electric connections have been cut off	Check the fuses, terminal boards and connection cables and if required replace them.	4.9
2	1 electric connection has been cut off.	See point 1.	4.9
3	Incorrect electric connection	Check electric system	4.9
4	Faulty motor	Check the electric motor	4.9

	Cause	Solution	Rif.
5	Rotors making contact	Stop the blower immediately and check the internal clearances of the rotors and of the gear	6.2.3 6.2.4
6	Scale deposits in the compression chamber	Clean the compression chamber and the rotors, balance the rotors if necessary	6.2.2
7	Intake of foreign particles	Remove the foreign particles, clean the compression chamber and check the clearances	6.2.3 6.2.3 6.2.4
8	Rotors are worn	Check the internal clearances	6.2.4
9	Bearing are worn	Replace the bearings	(1)
10	Gaskets are worn	Replace the gaskets	(1)
11	Drive shaft seal is worn	Replace the seal	6.2.1
12	Oil level plugs are broken	Replace the oil levels	(1)
13	Inlet piping is clogged	Check piping and remove obstruction	4.5.1
14	Outlet piping is clogged	Check piping and remove obstruction	4.5.2
15	Cooling circuit damaged (only /RV)	Restore the circuit	4.5.3
16	Speed of rotation different from rated value	Reset the rated value	(2)
17	Inlet temperature different from rated value	Reset the rated value	(2)
18	Cooling liquid capacity different from ratedvalue (only /RV)	Reset the rated value 4.5.3	4.5.3
19	Oil level too high	Reset correct oil level	6.1
20	Oil too viscous	Use less viscous oil	6.1.1
21	Oil produces foam	Change the type of oil	6.1.1
22	Transmission not aligned	Check the alignment	4.4

(1) To do this operation see service manual
(2) Check the plant

8 DISASSEMBLY AND REASSEMBLY

Disassembly the blower within the guarantee period results in the cancellation of the guarantee. Disassembly, repair work and reassembly of the blower must be carried out only by skilled personnel and with the aid of suitable equipment and relevant manual. This manual contains only the instructions for preventative maintenance. For any references to components see attached sections

Note: Guarantee does not cover damages caused by operations carried out incorrectly during disassembly and/or reassembly of the blower.

8.1 Disassembly

Warning: Before starting disassembly stop the blower by following the procedure described at page 3 of the present manual.

Disassemble the drive components (pulleys or coupling) following the manufacturerís instructions if there are locking devices or by means of an extractor if attached directly onto the shaft.

Warning: Do not hammer the shaft coupling or pulley.

Empty the cooling circuit (only /RV) and disconnect the relevant piping. Drain the lubricating oil from the sumps 12A e 12B

Warning: Dispose the used oil in accordance with local regulations

8.1.2 Disassembly of drive side sump

Remove the key 30. Loose the fixing screws and extract the sump 12A together with seal ring pos. 43

8.1.3 Disassembly of gear side sump

Loose the fixing screws and extract the sump 12B .

8.2 Reassembly

Before reassembly, thoroughly clean all components and lubricate with oil those components which have to slide over each other.

8.2.1 Reassembly of drive side sump.

Mount the seal ring 43 onto sump 12A using special equipment in order to avoid damaging the lip of the seal. Lubricate the lip of the seal and sliding housing on the shaft with grease. Mount the

sump 12A onto the cover 5A with a new gasket 50 in between.

Warning: Do not damage the lip of the ring 43.

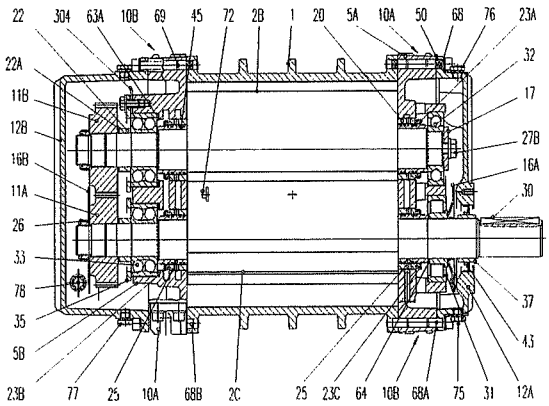
Secure the sump 12A with the relevant screws

8.2.2 Reassembly of gear side sump

Mount the sump 12B onto cover 5B with a new gasket 50 in between. Secure the sump 12B with the relevant screws.

Sectional drawing with parts description.

RBS 35-106



PART. N.	PART DESCRIPTION	No OF PARTS
1	Casing	1
2B-2C	Shaft + Rotor	2
5A-5B	Cover	2
10A	Right foot	2
10B	Left foot	2
11A	Driving gear	1
11B	Driven gear	1
12A-12B	Sump	2
16A-16B	Lubricating disc	2
17	Bearing lock disc	1
20	Sealing chamber	4
22	Gear spacer	2
23A	Oil splash disc	1
23B	Oil splash disc	2
23C	Oil splash disc	1
25	Sealing spacer	4
26	Gear locking nut	2
27B	Bearing locking screw	1
30	Key	1
31	Rolling bearing	1

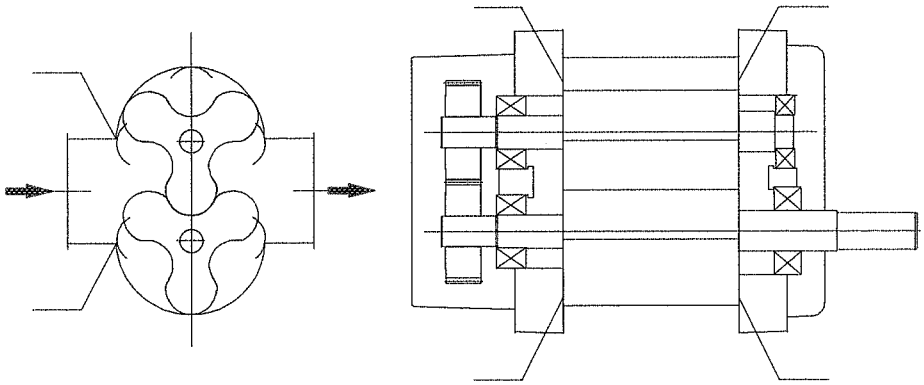
Part. N.	PART DESCRIPTION	No OF PARTS
32	Rolling bearing	1
33	Rolling bearing	2
35	Bearing cover	2
37	Shaft sleeve	1
43	Seal ring	1
45	Flexible piston ring	16
50	Gasket	2
63A	Compensating ring	6
64	Compensating ring	1
68	Centering pin (only RBS75-106)	2
68A	Centering pin (only RBS35-66 No 4)	2
68B	Centering pin (only RBS35-66 No 2)	1
69	Centering pin (only RBS75-106)	1
72	Plug	2
75	Oil draining plug (only RBS35-66)	1
76	Oil filling plug	2
77	Oil draining plug (RBS35-66 No 3)	4
78	Oil level plug	4
304	Adjustment plate	4

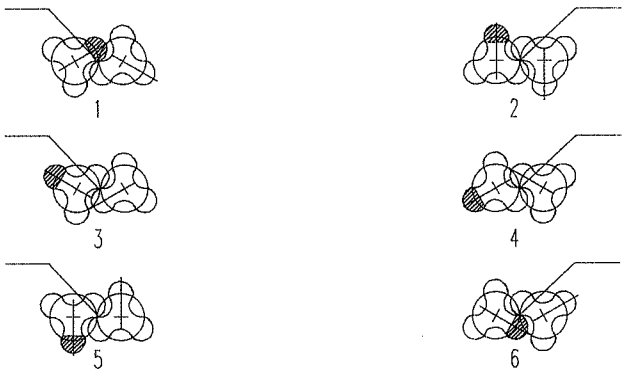
TABELLA RILIEVO DEI GIOCHI TABLE FOR TOLERANCES CHECK	Tabella N - Table N. 264468

Soffiatore / Blower _____ Matricola / Serial N. _____

Note / Notes _____

Giochi espressi in 1/100 mm - Tolerances in 1/100 mm





Ruotare l'albero conduttore in senso antiorario-Rotate drive shaft counterclockwise

Gioco tra i fianchi dei denti dell'ingranaggio
Tolerances between gear sides _____

Gioco cuscinetti Bearing tolerances		Albero conduttore Drive shaft	Albero condotto Driven shaft
Radiale Radial	Lato comando Drive side		
	Lato ingranaggio Gear side		
Assiale - Axial			

Data / Date ___/___/___ Firma / Signature _____

Hamworthy Moss AS

Part no: M1303-001

TG: Item: 82

Rev: 01

Date: 20050705

FUEL OIL PUMP

E4 NA-1001 6P

This is a general specification leaflet ; for specific applications not covered herein, contact Suntec.

The SUNTEC **E 1001** oil pump incorporates a pressure regulating valve with cut-off function. Its design is basically similar to that of J pumps, but E pumps can also be used with heavy oil.

APPLICATIONS

- Light, medium and heavy oil.
- One or two-pipe system.
- Normally associated with in-line solenoid valve.

PUMP OPERATING PRINCIPLE

The gear set draws oil from the tank through the built-in filter and transfers it to the valve that regulates the oil pressure to the nozzle line. All oil that does not go through the nozzle line will be dumped through the valve back to the return line in two pipe installation or, if it is a one-pipe installation, back to the suction port in the gear-set. In that case, the by-pass plug must be removed from the return port and the return port sealed by steel plug and washer.

The valve also has a cut-off function as follows :

During starting period when the gear-set speed is increasing, all the oil passes through a special flat on the piston, back to the return. Once the speed reaches a certain value and the flow can no longer pass through this flat, then the pressure increases rapidly overcoming the valve spring force and opens the valve.

During the stop sequence, the gear-set speed slows down and the valve closes when the gear-set capacity is lower than the flat flow.

The cut-on and cut-off speeds depend on the gear-set size and set pressure.

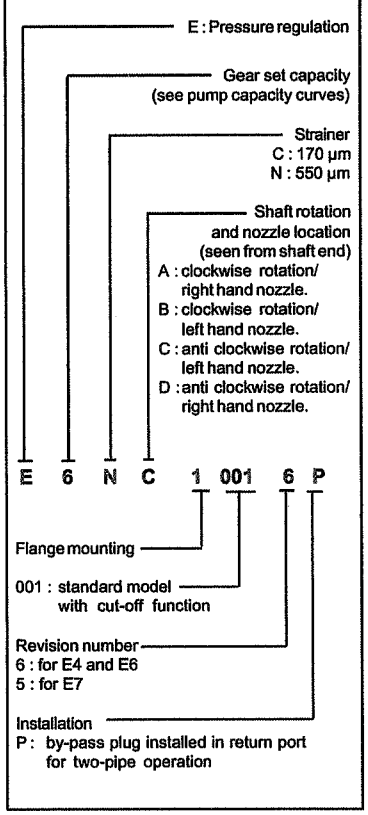
Bleed :

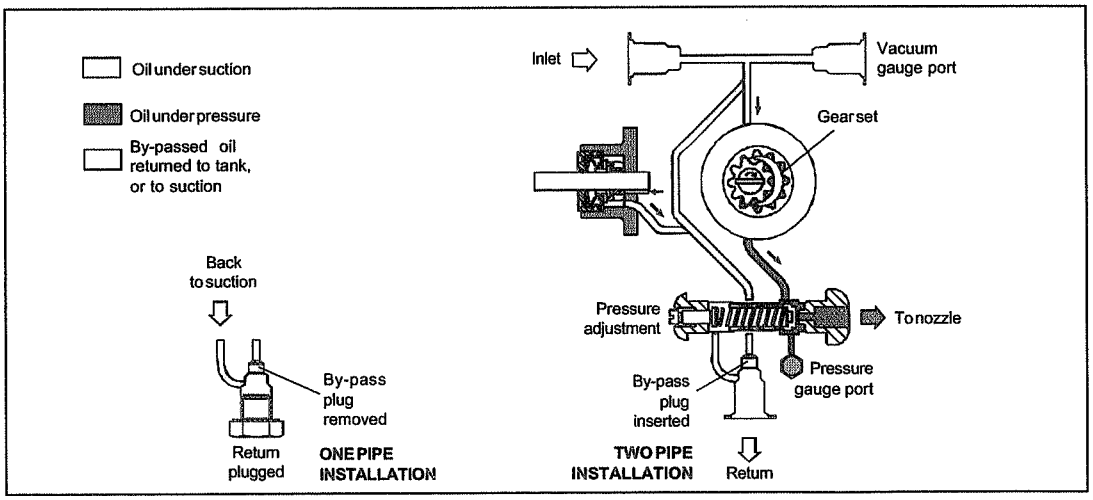
Bleeding in two pipe operation is automatic, but it may be accelerated by loosening the plug in a pressure gauge port.

In one pipe operation, a pressure port must be opened to bleed the system.

PUMP IDENTIFICATION

(Not all model combinations are available Consult your Suntec representative)





Hamworthy Moss AS

Part no: M1303-001 Item:

TECHNICAL DATA

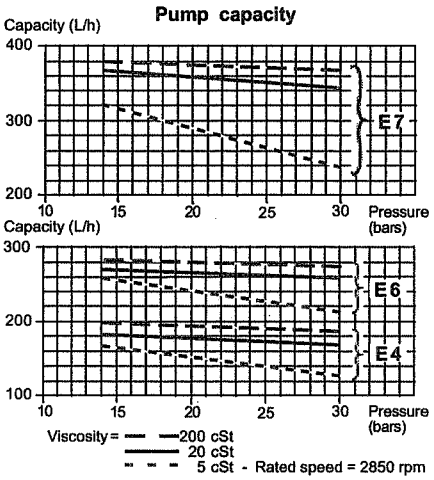
General

Mounting	Flange mounting according to EN 225.
Connection threads	Cylindrical according to ISO 228/1
Inlet and return	G 1/2
Nozzle outlet	G 1/4
Pressure gauge port	G 1/8
Vacuum gauge port	G 1/2
Valve function	Pressure regulating and cut-off
Strainer	Open area : 45 cm² Opening size : C = 170 µm N = 550 µm
Shaft	Ø 11mm according to EN 225.
By-pass plug	Inserted in return port for 2 pipe system; to be removed with a 3/16" Allen key for 1 pipe system.
Weight	4 kg

Hydraulic data

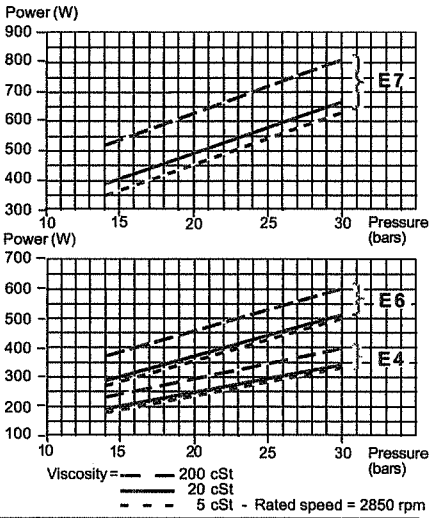
Nozzle pressure range	14 - 30 bars
Delivery pressure setting	20 bars
Operating viscosity	2,8 - 450 mm²/s (cSt)
Oil temperature	0 - 90°C in the pump.
Inlet pressure	1,5 bars max.
Return pressure	1,5 bars max.
Suction height	0,45 bars max. vacuum to prevent air separation from oil.
Rated speed	3600 rpm max.
Torque (@ 45 rpm)	0,30 N.m

Pump capacity



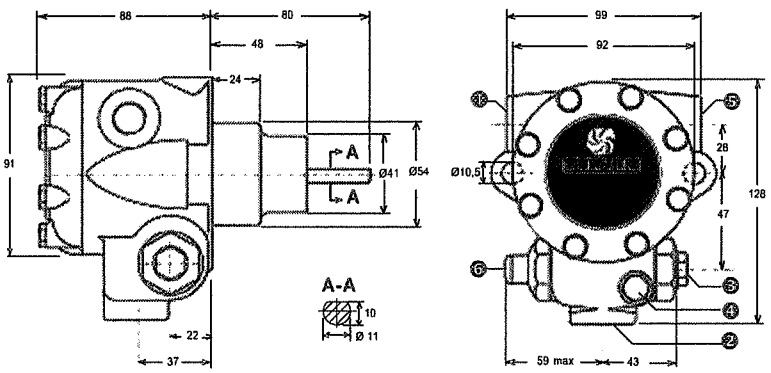
Data shown take into account a wear margin. Do not oversize the pump when selecting the gear capacity.

Power consumption



PUMP DIMENSIONS

Example shows "C" rotation and nozzle outlet.



1. Suction or vacuum gauge port
2. Return and internal by-pass plug
3. Nozzle outlet
4. Pressure gauge port
5. Vacuum gauge port or suction
6. Pressure adjustment

11 - 154

Hamworthy Moss AS

Part no: M1361-001 TG: Item: 86

Rev: 01 Date: 20050608

OIL NOZZLE MAIN BURNER

D Saphir - 60°

7,5 USG/H

	Typ	Zerstäubungswinkel		
		45°	60°	80°
	D	0,40 à 50	0,40 à 50	0,40 à 50

Standard-Leistung in USG/h	0,40	0,75	1,25	1,75	2,75	4,00	6,00	8,00	10	12	16	20	28	40
	0,50	0,85	1,35	2,00	3,00	4,50	6,50	8,50	10,5	13	17	22	30	45
	0,60	1,00	1,50	2,25	3,25	5,00	7,00	9,00	11	14	18	24	33	50
	0,65	1,10	1,65	2,50	3,50	5,50	7,50	9,50	11,5	15	19	26	36	

Leistung bei einem Druck von 7 bar:
1 USG = 3,785 l

Filter aus Monelgewebe:
200 Maschen bis 2,00 USG
120 Maschen über 2,00 USG

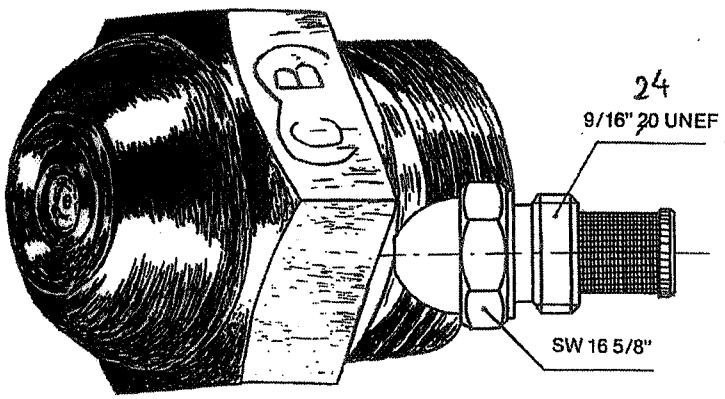
Viskosität: 1,3° E

Karton-Verpackung: 12 Stk.
Karton-Verpackung: 20 Stk.
Metallkoffer: 42 Stk.
Jede Düse wird individuell geprüft.

Bestellungs-Beispiel:	Stückzahl	Typ	Winkel	Leistung
	12	D	60°	1,50 USG/h

VORTEILE DER SAPHIRDÜSE

1.) **Feinere Zerstäubung**
2.) **Bessere Verbrennung**
3.) **Energiesparend**
4.) **Hoher Widerstand gegen Verschleiss und Korrosion**



Hamworthy Moss AS

Part no: M5541-002txt FG:Item: 100, 101

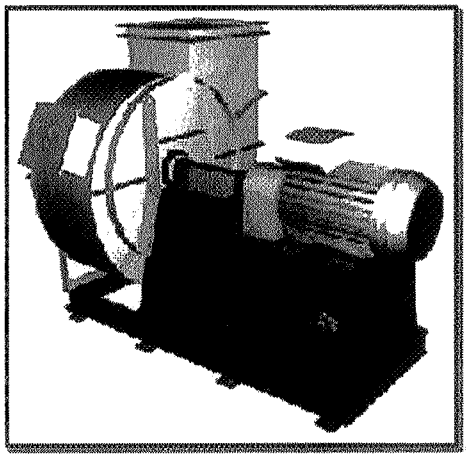
Rev: 03

Date: 20070904

CENTRIFUGAL FANS - AIR

Installation, operation and maintenace

Instruction



General information

Unloading and handling

Precautions are taken in our works when packing and loading to ensure safe arrival of fan equipment on site. Careless handling during transit, when unloading and when erecting, can result in serious damage, and every reasonable care must be taken during these operations.

NB! AS SUPPLIER OF THESE SMALL AND SELF CONTAINED FAN UNITS: -STATES THAT ALL THESE UNITS SHALL ALWAYS BE LIFTED USING THE LIFTING POINTS PROVIDED AND INDICATED WITH MARKER.

Storage

Fan should be stored in a clean dry atmosphere free from vibration. It is recommended that the fan shaft should be given an occasional (eg. weekly) rotation to prevent brinelling of the bearing races.

Installation of centrifugal fans

1. Before installation check that there is no transport-damage to fan or other supplied equipment.
2. Install the fan to a flat level surface.
3. The fan must be placed on a solid foundation to carry the total weight of fan.

Check that the deck of ship has sufficient stiffness.

4. Assemble anti vibration mountings under the fan foundation.
5. Ensure that all anti vib.mount. are correctly adjusted.

No anti vibration mountings to be fully loaded.

6. Check that the fan is completely level.
7. Check that no foreign objects remains in fan housing.
8. Check that clearance between impeller and inlet is correct.
9. Drain pipes must have sufficient natural slope.
10. Fixed Cabletrays must not be tied up between fan, walls, deck-floor etc..
11. Fans connected to ducts are required to have a flexible connection assembled to inlet and outlet of fan.
12. Fans inlet/outlet shall not have any duct-loading . Ducts must be supported from ceiling or additional structure around fan.
13. Intervals of greasing must be in accordance with motors maintenance.
14. Fans with free inlet shall have a minimum distance from inlet to wall
    = 1 x D(inlet diameter)

Mounting of bend-sections directly forehand of fan inlet without the correct distance between bend and fan, will reduce the effect of the supplied fan. *Air-flow will then be reduced.*

Anti-vibration Mountings

Where anti-vibration mountings are fitted it is most important that the fan is isolated from surrounding ductwork by means of flexible connections on both inlet and outlet.

In the case of a V-belt driven fan unit the fan and motor must be mounted on a combination base plate to enable anti-vibration mounts to be used.

For installation and setting details, see manufacturer's leaflet.

Starting up

On initial starting up, proceed as follows:

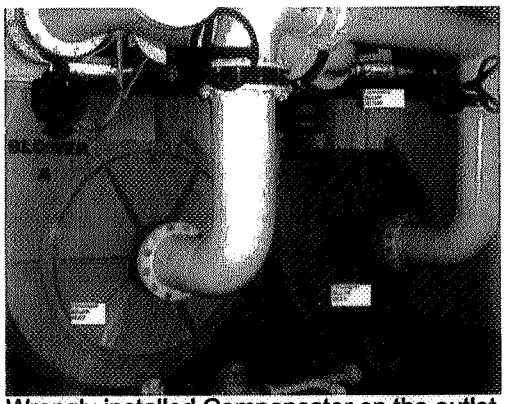
1. Check that there is no debris in fan casing
2. Rotate impeller by hand to check freedom
3. Check that all holding down bolts are tight
4. Close dampers and inlet control
5. Check driving unit for correct rotation
6. Start up
7. Open dampers when fan is at operating speed

Marine Fans (Inert Gas)

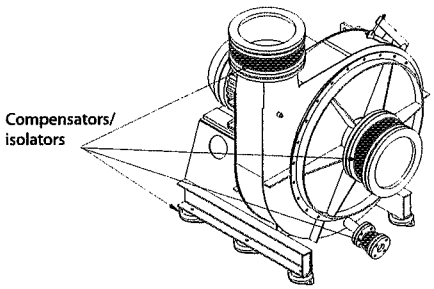
It is most important that the fan is isolated from the surrounding ductwork by means of flexible connections on both inlet and outlet flange to avoid placing on fan components.

On installation near a ship's engine room there is a risk of brinelling during stand down periods. We therefore recommend that the shaft is given an occasional (eg. weekly) rotation during these periods.

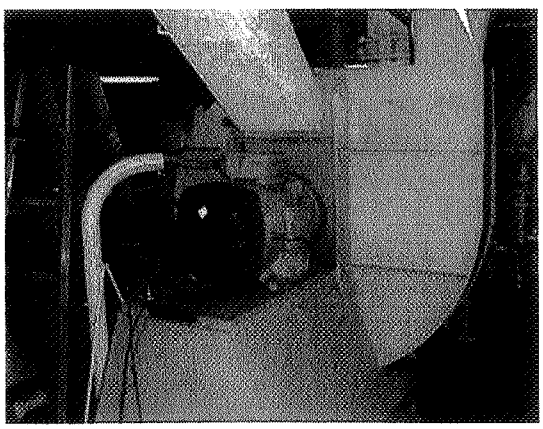
Precautions



Wrongly installed Compensator on the outlet. Compensator should be placed between the fan and the ducting system. Wrongly installed compensators on the drain system. Compensator should be placed between the fan and the piping system.



Above picture shows how compensators and isolators shall be connected to the fan.

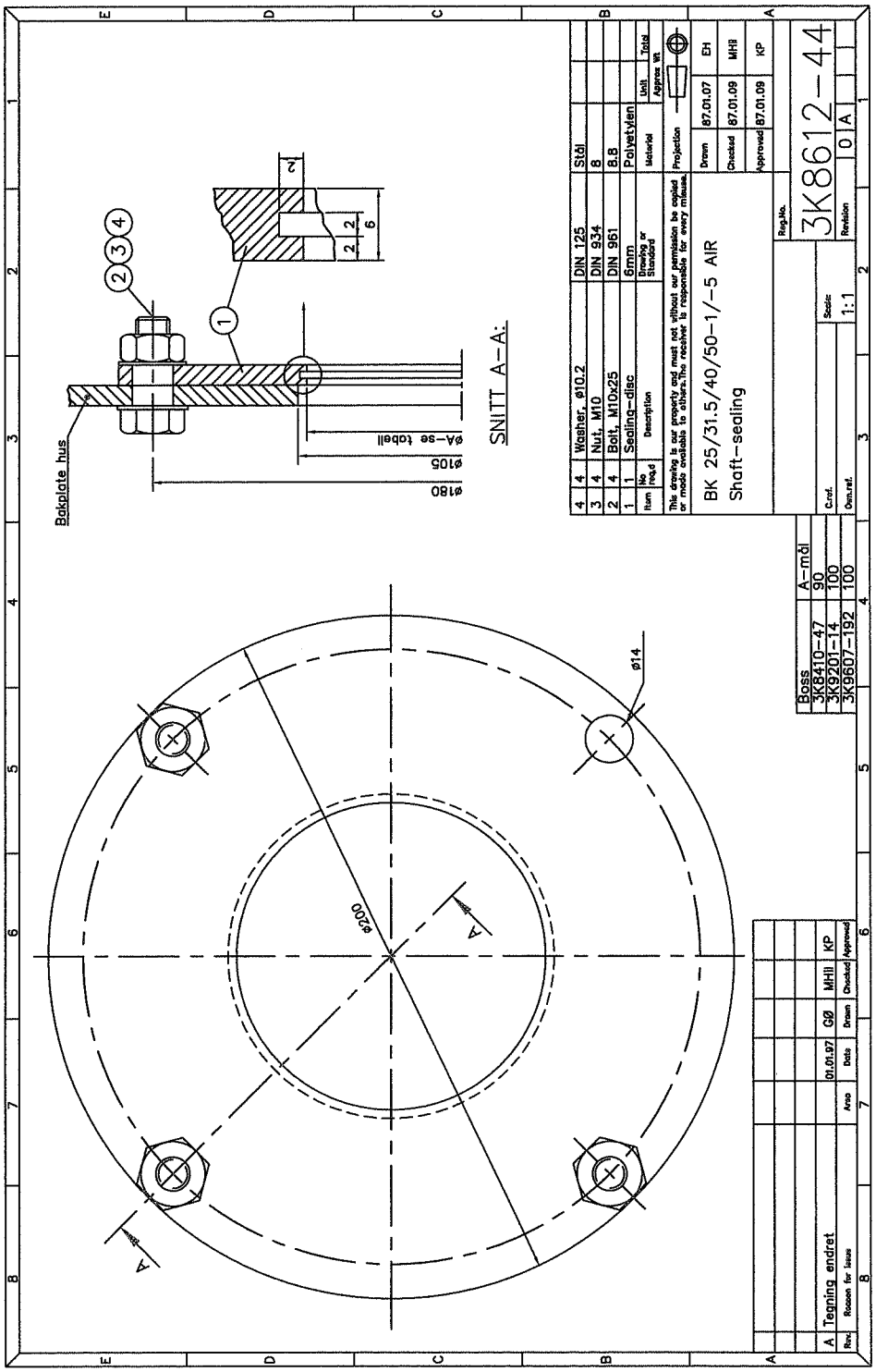


Wrong: Cables are connected to fan (left)

Correct: Separat cable tray (right)

Hamworthy Moss AS

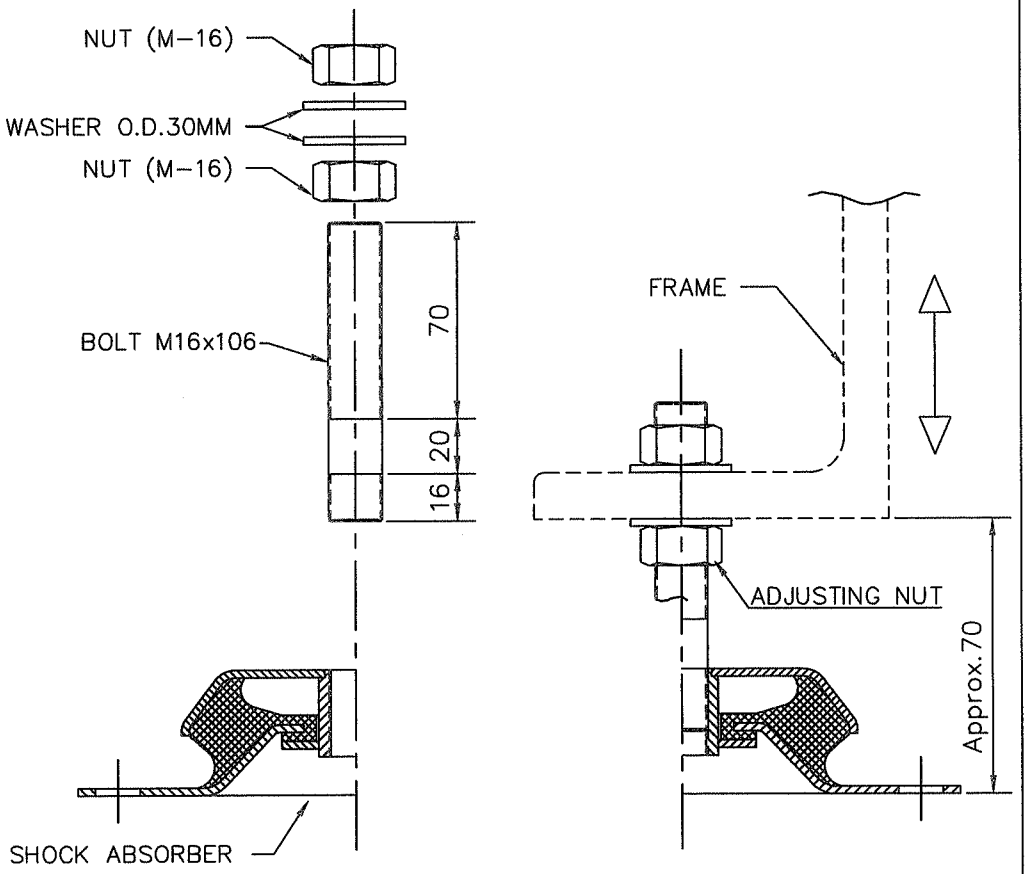
Part no: M5541-002txt Item:



Hamworthy Moss AS

Part no: M5541-002txt **Item:**

Rev.	Reason for issue	Area	Date	Drawn	Checked	Approved
-						
-						
-						
A	Bolt type altered	----	18.10.04	St.J	JOG	JOG



Item	No req,d	Description	Drawing or Standard	Material	Unit / Total Approx Wt

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Projection

Drawn	99.02.08	TFS
Checked	99.02.10	M.HIL
Approved	21.09.01	M.HIL

Schock absorber
RA-350A and B with stop

Reg.No. 4K9902-23

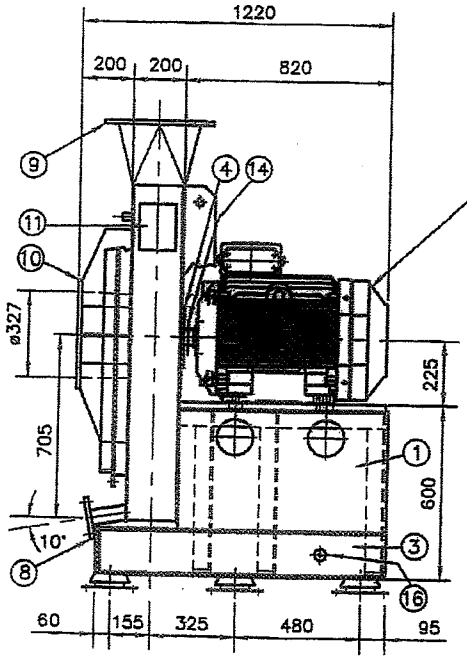
C.ref.

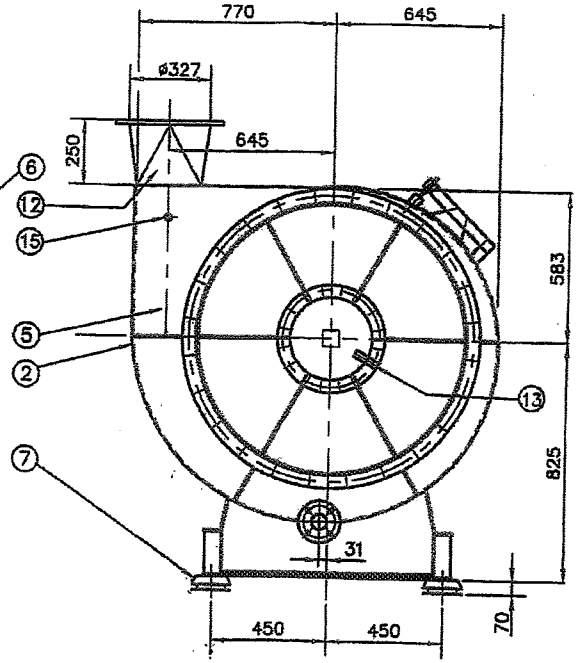
Own.ref.

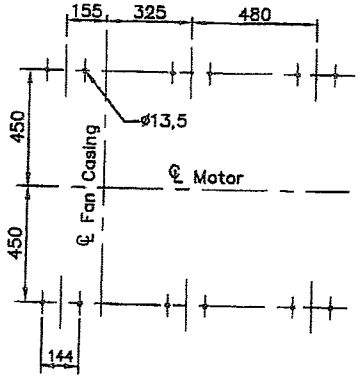
Scale: —

Revision 0 A

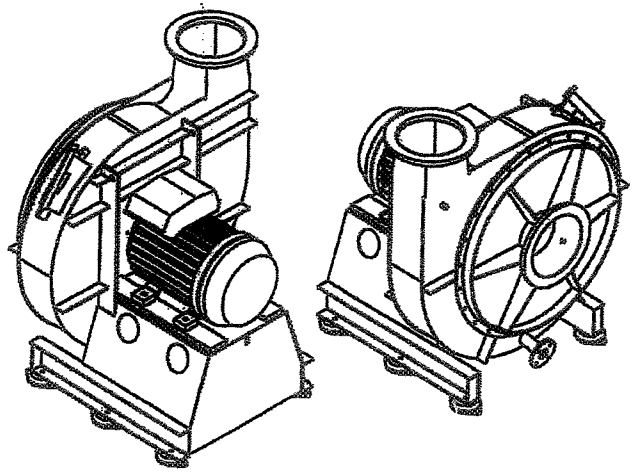
Rev.	Reason for issue	Area	Date	Drawn	Checked	Approved
-						
-						
-						
-						





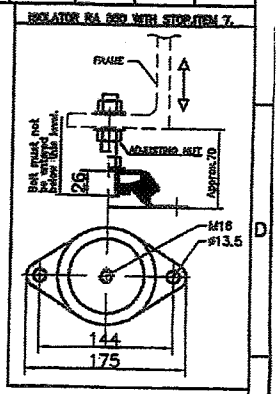


Foundation location



Note 1:
ABB,M3BP 225SMC–2
65kW,440V,60Hz,IP55,3550rpm.

Total weight :1000kg



Item	No req,d	Description	Drawing or Standard	Material	Unit Approx Wt	Total
16	1	Earthing		AISI316L		
15	1	Socket	1/2"BSP	AISI316L		
14	1	Deflection disc	4K9011–7	AISI316L		
13	1	Spray nozzle	3K9104–25			
12	1	Transition duct out.		St.37.2		
11	1	Hatch	2K8206–35	St.37.2		
10	1	Inlet flange DN300	NS2526.PN10	St.37.2		
9	1	Outlet flange DN300	NS2526.PN10	St.37.2		
8	1	Drain DN 50	NS2527.PN10	St.37.2		
7	6	Isolator RA350–A	4K9902–23	See det.		
6	1	Motor see note 1				
5	1	Fan wheel	2K9612–85	AISI316L		
4	1	Shaft seal	22000–021			
3	1	Frame	UPE 180			
2	1	Fan casing	12000–006	St.37.2		
1	1	Support for motor 200–280	22000–005	St.37.2		

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Projection

CENTR. FAN FOR HIGH PRESSURE
BK 25–1, ARRANGEMENT GAS
For fan wheels up to ø1060

Drawn	12.05.06	M.HIL
Checked	12.05.06	M.HIL
Approved	12.05.06	KP

Reg.No. 32006–147

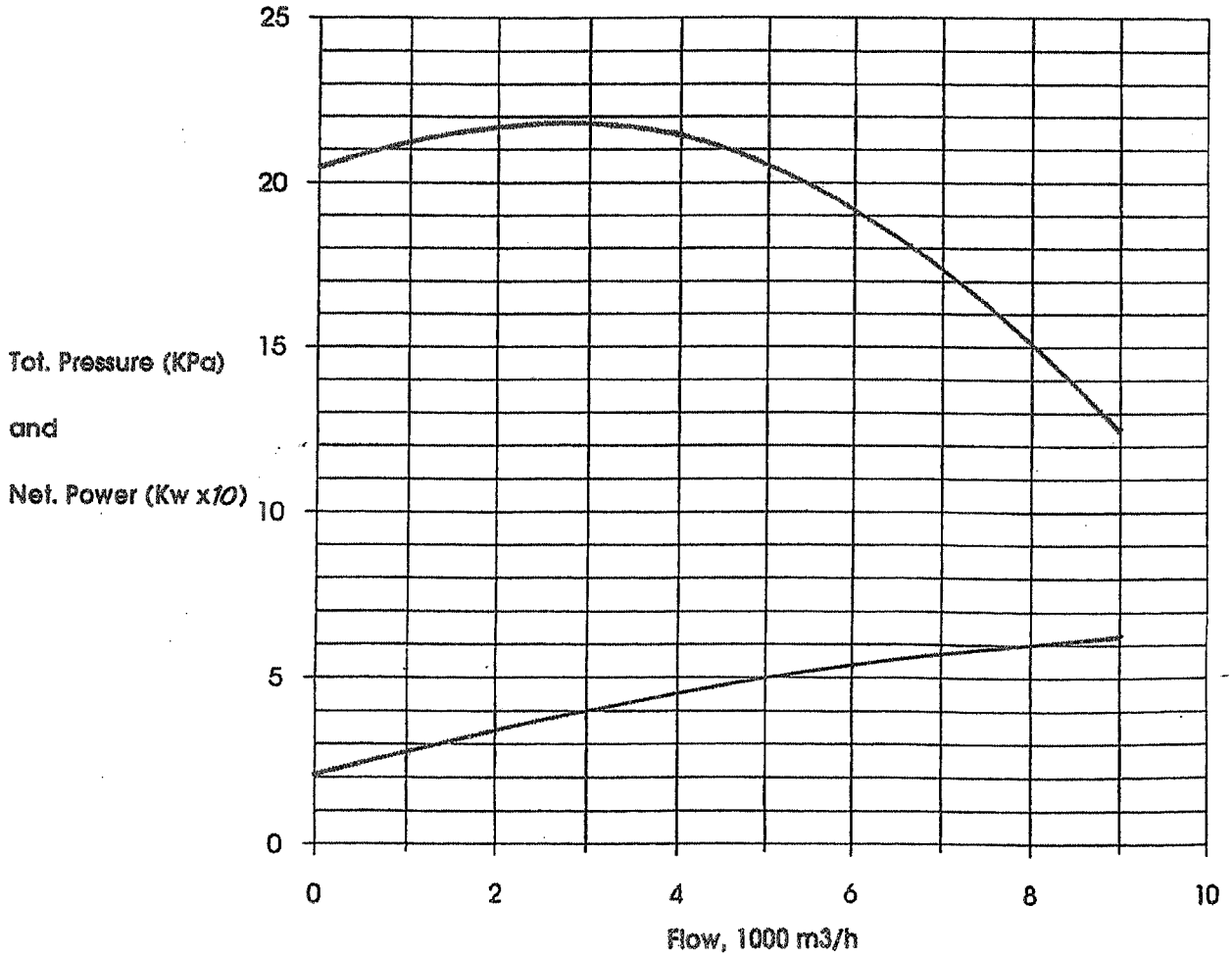
C.ref.
Dwn.ref. 25–1G16
Scale: 1:20
Revision 0

091-11

FG: Item 100
101

4K9901-02

Diagram for FLEBU fan type..BK25....ø920/35, 5
Inlet Diameter, cm: .....25.....
Impeller Speed, RPM: .....3550.....
Inlet Gas Density, kg/m3: ....1..12.....
Inlet Gas Temperature, C: ..20.....



Hamworthy Moss AS

Part no: N0041-001txt

FG: Item: 105, 106

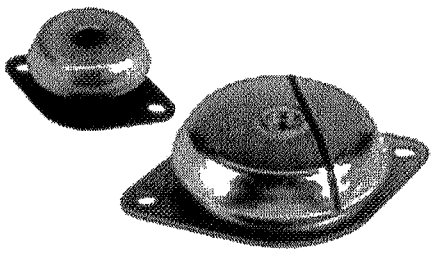
Rev: 02

Date: 20050606

RESILIENT MOUNTING

Type RA

User manual



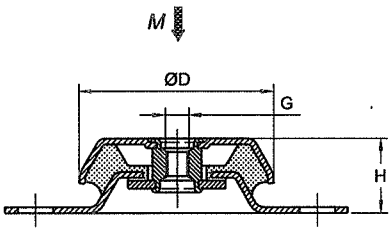
Features

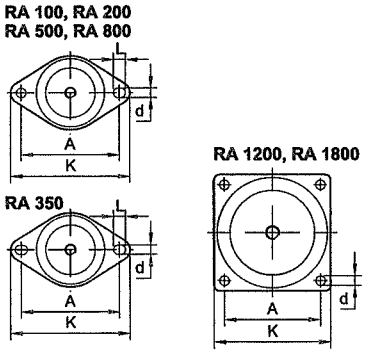
RA uses the rubber profile in shear and compression obtaining good vertical flexibility with the advantage of horizontal stability. For normal speeds of approx. 1500 rpm the RA type provides a degree of isolation of 75-85%. For even better isolation, the alternative RAEM or M can be chosen.

It's unique construction and the lates production methods make the type RA a high performance mounting having a number of advantages:

- Rubber features are utilized effectively combining compression and shear.
- Tight tolerances on dynamic stiffness rate for accurate vibration calculations.
- Wide load rating options, 40-2100kg.
- Corrosion protected to cope with harduous environments on land or marine applications (Fe/Zn 8C as per ISO 2081).
- Stronger base metal withstands high shock loads without deformation.
- Fitted as standard with a shock-proof device (up to 5G) with resilient stop, making RA ideal for use on mobile or marine applications.
- Clear and durable product marking so that mountings can be identified even after several years in operation.
- Domed shape cover to protect against oil contamination.

Type	Art.no. Hardness A (40° IRH)	Art.no. Hardness B (60° IRH)	Dimensions in mm D	A	H	K	d	t	G	Weight (kg)	M-Max(kg) A(40° IRH)	B(60° IRH)
RA 100/M10	1861700	1861710	79	110	30	130	9	2	M10	0.330	95	190
RA 100/M12	2256120	2256130	79	110	30	130	9	2	M12	0.330	95	190
RA 200/M10	1861740	1861750	94	124	35	150	10	2,5	M10	0.470	180	270
RA 200/M12	2255720	1860350	94	124	350	150	10	2,5	M12	0.470	180	270
RA 350/M12	2256370	2256380	101	140-148	38	175	14	3	M12	0.737	250	450
RA 350/M16	1861760	1861770	101	140-148	38	175	14	3	M16	0.737	250	450
RA 500	1861800	1861810	123	158	42	192	14	3	M16	1.020	400	600
RA 800	1861820	1861830	144	182	48	216	14	3	M16	1.589	750	1300
RA 1200	2255360	2255370	161	140	58	170	14	3	M20	2.188	900	1600
RA 1800	2255380	2255390	181	160	66.5	190	14	3	M20	2.325	1300	2100





11-162

Hamworthy Moss AS

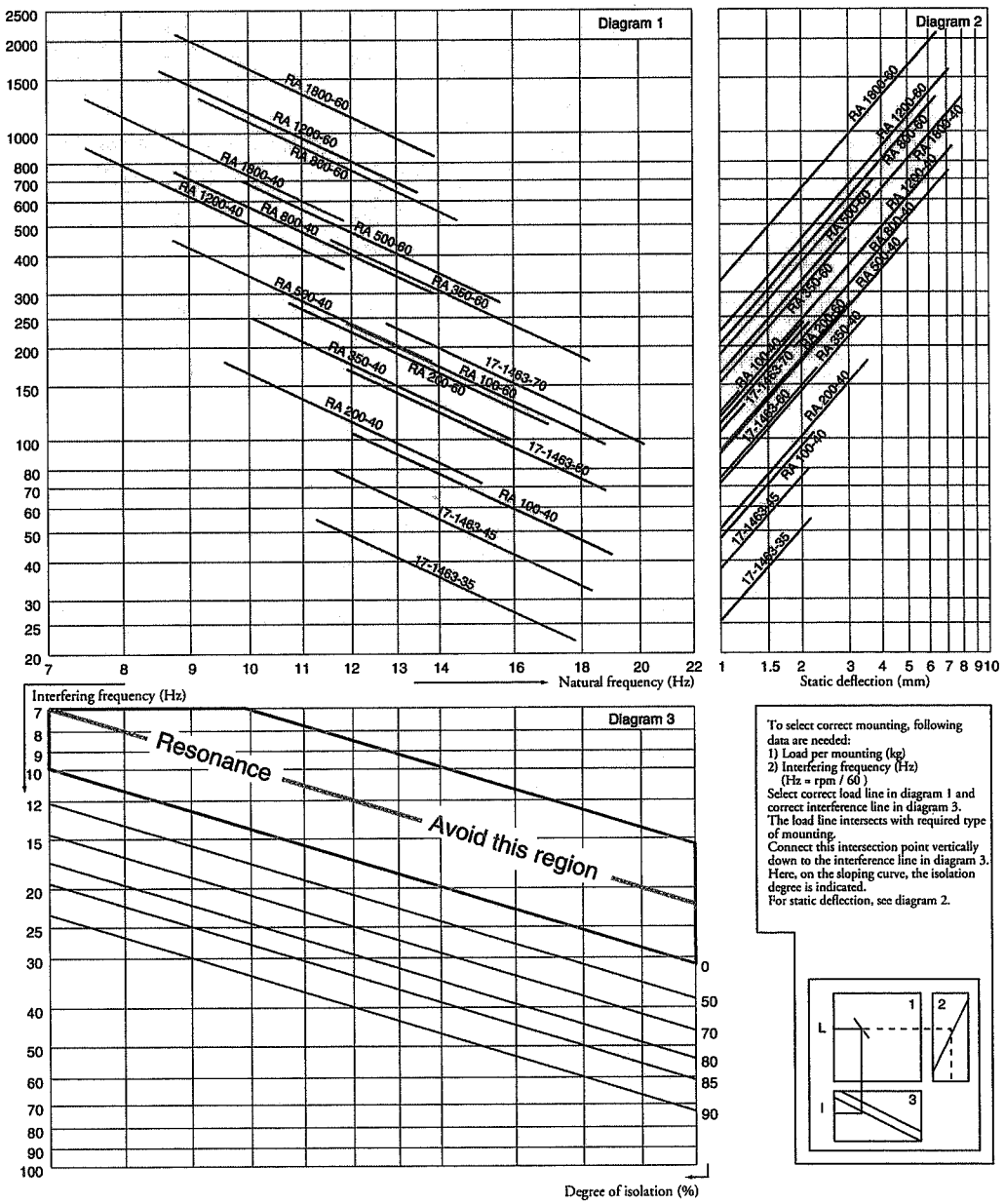
Part no: N0041-001txt Item:

Application

For the effective isolation of vibration and noise on different machines with rotating movements, like:

- Compressors
- Combustion engines
- Generators
- Converters
- Pumps
- Industial and marine gen sets
- Fans
- Also suitable for use with presses, punches and other workshop machines.

Note: The natural frequencies and degrees of isolation are based on dynamic characteristics of the mountings.



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Hamworthy Moss AS

Part no: M7676-001

FG: Item: 107, 108

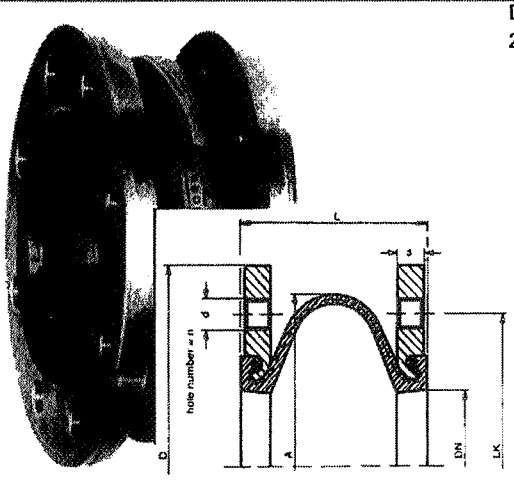
Rev: 01

Date: 20050606

FLEXIBLE BELLOW

DN300 DIN PN10

T-49 YELLOW / NBR



Flanges:

Loose flanges of steel st. 37,2, stanless steel, plastic etc. drilld to ASA, DIN, BS, JiS,etc. with threated holes, galvanized or painted to your specifications.

For the entire industry, shipbuilding, power plants, pipelines, heating-, cooling, and ventilating systems, fuel stations etc.
To absord noises, vibrations and shocks as well as axal, lateral or angular movements.
For settlement of bildings and containers, for absorption of vibrations and oscillations, for electrical insulation, for nearly total absorption of noises in pipelines, house installations, heating plants, pumps and motor connections.

Type	Op.Press (68oF/20oC)	Core	Cover	Colour Code
"N"	232 psi/16bar	Neoprene	Neoprene	grey
	for waste, cold and hot water up to 140oF(60oF)at 145 psi(10bar)			
"P"	290 psi/20bar	Nitrile	Neoprene	bkue
	food quality according to DIN 7725 for drinking water up to 158oF at 145psi(10bar)			
"HB"	232 psi/16bar	EPDM	EPDM	red
	for heatings (hot water up to 230oF(110oC) with TUV-certeficate			
"B"	232 psi/16bar	EPDM	EPDM	orange
	for drinking an hot water up to 194oF(90oC) at 145 psi(10bar)			
"PM"	232 psi/16bar	Perbunan	Neoprene	yellow
	oil,grease,petrol or gas up to 176oF(80oC) at 145 psi(10bar)with DVGW-certificate			
"H"	232 psi/16bar	Hypalone®	Hypalone®	green
	for acids and chemicals, pressure and temperature as per aggressiveness			

Bellows:

Smooth inside and outside layers, reinforced with super strong piles of Nylon or Nomex with inserted steel cord reinforcing, with at both ends profiled vulcanized rubber bulges which operate as sealings.

DMN mm	Length L mm	Ext.Diam of Bellows mm	Flange PN 10 DØ mm	LKØ mm	Ød	n	s mm	Max. Movements axial + mm	-mm	+/-mm	angular <o	Thickness of flange mm	Total Weight kg
300	100	410	445	400	M20	12	20	20	35	15	5	20	22,5

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Hamworthy Moss AS

Part no: N3295-002 Item: 141

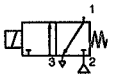
Rev: 02

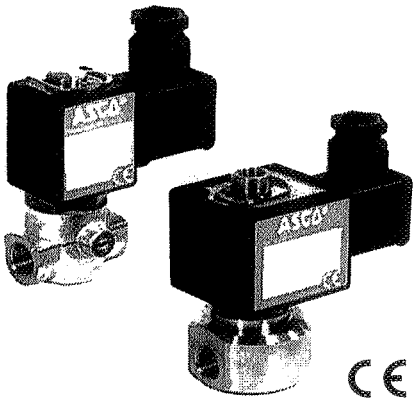
Date: 20070824

SOLENOID VALVE

3/2-way NC air

Direct operated 1/4

NC 



FEATURES

- Solenoid valves comply with all applicable EC Directives
- Compact and low weight valve enabling easy installation
- Epoxy moulded coil for general service applications
- Coils interchangeable without dismantling the valve

GENERAL

Differential pressure = 10 bar

Maximum viscosity = 40 cSt (mm2/s)

Response time = 8 - 20 ms (with air DP = 6 bar)

MATERIALS IN CONTACT WITH FLUID

Body	Brass
Internal parts, spring	Stainless steel
Seat	Brass
Sealings	NBR
Shading coil	Copper

ELECTRICAL CHARACTERISTICS

Coil insulation class	F
Connector	Spade plug (pg 11P)
Connector specification	ISO 4400
Electrical safety	VDE 0580
Voltage	DC (=): 24V

Fluids	Temperature range (TS)	Sealings
water, air, inert gas, oil	-25°C to +80°C	NBR (nitrile / buna-n)

Ambient temperature range (TS) (°C)
-25° to + 60°

SPESIFICATIONS

Pipe size	Orifice size	Flow coefficient Kv				Operating pressure differential (bar)			Coil type	Type number (Brass)
	2-1	2-1		1-3		min.	maximum (PS)			
G	mm	m3/h	l/min	m3/h	l/min		air	water/oil		
1/4	2,7 (1)	0,22	3,6	0,15	2,5	0	10	10	CMXX-FT	SC E374A017 MS

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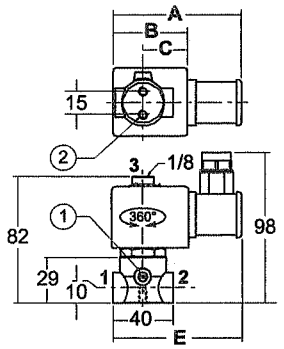
Hamworthy Moss AS

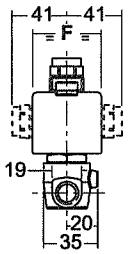
Part no: N3295-002 Item: 141

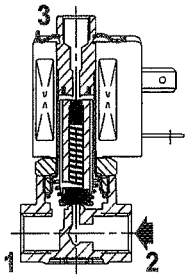
INSTALLATION

- The valves can be mounted in any position without affecting operation
- Valves have 2 mounting holes in the body
- Pipe connections 1/4 (G*) has standard combination thread according to ISO 228/1 and ISO 7/1. Pipe conection G 1/8 has standard thread according to ISO 228/1
- The third digit in the catalogue number indicates the standard pipe connection
- Other pipe connections are available on request
- Spare Parts Kits and replacement coils are available

Dimensions (mm), Weight (kg)







NC function

Ports 1 and 2: 1/4

Port 3: 1/8

Pressure inlet:
Function NC = Port 2

Coil type	A	B	C	D	Weight brass
CMXX-FT	85	64	45	84	0,510

1. Manual operator location.

2. 2 mounting holes Ø M4, depth 6mm.

Hamworthy Moss AS

Part no: N3296-002 Item: 152,157

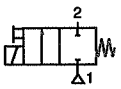
Rev: 02

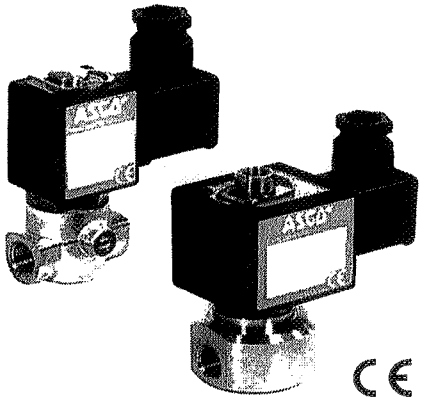
Date: 20070824

SOLENOID VALVE

2/2-way NC air

Direct operated 1/4

NC 



FEATURES

- Solenoid valves comply with all applicable EC Directives
- Compact and low weight valve enabling easy installation
- Epoxy moulded coil for general service applications
- Coils interchangeable without dismantling the valve

GENERAL

Differential pressure = 15 bar

Maximum viscosity = 40 cSt (mm2/s)

Response time = 8 - 20 ms (with air DP = 6 bar)

MATERIALS IN CONTACT WITH FLUID

Body	Brass
Internal parts, spring	Stainless steel
Seat	Brass
Sealings	NBR
Shading coil	Copper

ELECTRICAL CHARACTERISTICS

Coil insulation class	F
Connector	Spade plug (pg 11P)
Connector specification	ISO 4400
Electrical safety	VDE 0580
Voltage	DC (=): 24V

Fluids	Temperature range (TS)	Sealings
water, air, inert gas, oil	-25°C to +80°C	NBR (nitrile / buna-n)

Ambient temperature range (TS) (°C)
-25° to +60°

SPESIFICATIONS

Pipe size (G)	Orifice size (mm)	Flow coefficient Kv		Operating pressure differential (bar)				Coil type	Type number (Brass)
				min.	maximum (PS)				
		(m3/h)	(l/min)		air	water	oil		
1/4	2,7	0,22	3,6	0	15	15	15	CMXX-FT	SC E272A017 MS

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Part no: N3296-002 Item: 152,157

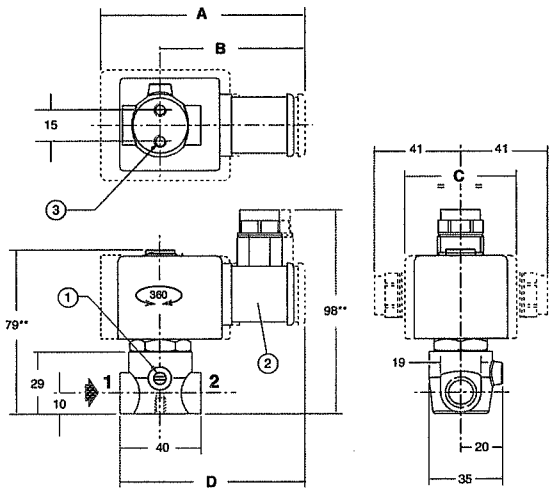
INSTALLATION

- The valves can be mounted in any position without affecting operation
- Valves have 2 mounting holes in the body

Dimensions (mm), Weight (kg)

- Pipe connections (G*) have standard combination thread according to ISO 228/1 and ISO 7/1
- Spare Parts Kits and replacement coils are available

Brass body version



Coil type	A	B	C	D	Weight brass
CMXX-FT	85	64	45	84	0,510

1. Screwdriver manual operator (suffix MS)

2. Connector rotatable by 90 increaments (Pg 11P)

3. Mounting: Two M4, depth 6

* +15 mm for connector removal

** +41 mm for coil removal

Hamworthy Moss AS

Part no: N3297-003 Item: 158

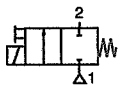
Rev: 02

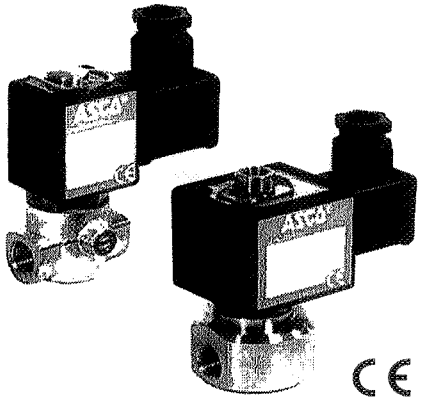
Date: 20070824

SOLENOID VALVE

2/2-way NC oil

Direct operated 1/4

NC 



FEATURES

- Solenoid valves comply with all applicable EC Directives
- Compact and low weight valve enabling easy installation
- Epoxy moulded coil for general service applications
- Coils interchangeable without dismantling the valve

GENERAL

Differential pressure = 40 bar

Maximum viscosity = 40 cSt (mm2/s)

Response time = 8 - 20 ms (with air DP = 6 bar)

MATERIALS IN CONTACT WITH FLUID

Body	AISI316L
Internal parts, spring	Stainless steel
Seat	Stainless steel
Sealings	NBR
Shading coil	Copper

ELECTRICAL CHARACTERISTICS

Coil insulation class	F
Connector	Spade plug (pg 11P)
Connector specification	ISO 4400
Electrical safety	VDE 0580
Voltage	DC (=): 24V

Fluids	Temperature range (TS)	Sealings
water, air, inert gas, oil	-25°C to +80°C	NBR (nitrile / buna-n)

Ambient temperature range (TS) (°C)	-25° to + 60°

SPESIFICATIONS

Pipe size (G)	Orifice size (mm)	Flow coefficient Kv		Operating pressure differential (bar)				Coil type	Type number (Stainless)
				min.	maximum (PS)				
		(m3/h)	(l/min)		air	water	oil		
1/4	2,0	0,11	1,8	0	40	40	40	CMXX-FT	SC E272A046 MS

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Hamworthy Moss AS

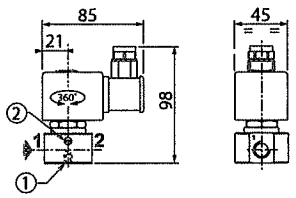
Part no: N3297-003 Item: 158

INSTALLATION

- The valves can be mounted in any position without affecting operation
- Valves have 2 mounting holes in the body

Dimensions (mm), Weight (kg)

- Pipe connections (G*) have standard combination thread according to ISO 228/1 and ISO 7/1
- Spare Parts Kits and replacement coils are available



1. 2 mounting holes Ø M4, depth 6 mm.

2. Manual operator location.

Hamworthy Moss AS

Part no: M0184-001

FG: Item: 182, 188, 204

Rev: 01

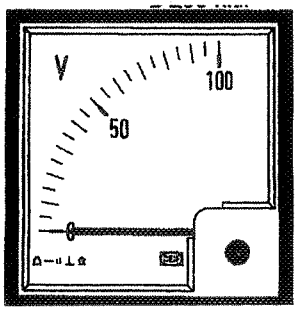
TG: 220

Date: 20050601

INDICATING INSTRUMENT

Type DQ72 - X

Input range 4-20 mA



Quadratic moving coil instruments

- Type: DQ72-x
- Measuring range - V[1]: 60mV..600V
- Measuring range - A[2]: 1 mA...5-10-15-40A[3], 4...20mA

1.Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 6 and multiples of 10 thereof.

2.Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 6 and multiples of 10 thereof.

3.Higher measuring ranges: For use with standard shunt: 60mV or 150mV. Supplied with shunt lead, 2 x 1m - 1mm^2 (0,035Ω).

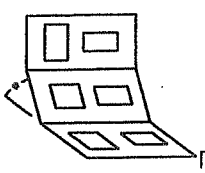
- Application: Measurement of DC currents and DC voltages.
- Scale: Linear
- Scale lengths: DQ72 -x: 62 mm
- Accuracy: Class 1.5
- Burdens: Voltmeters: 1mA, Ri: 1kΩ /V Ammeters: 60mV...0.5V
- Housings: Plastic

General technical specifications

Instruments are designed according to below mentioned standards		Standards
Accuracy	Class 1.5 (-10...15...30...55°C) Line scales: ±1,5% of full scale value (FS) Non-linear scales: ±1,5% of scale length	EN 60051 and IEC 51
Instrument size	72 x 72 mm	DIN 43700
Bezel	Slim bezels	DIN 43718
Scale/pointer	Standard pointer	DIN 43802

Hamworthy Moss AS

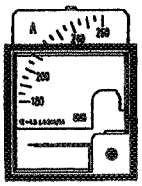
Part no: M0184-001 Item:

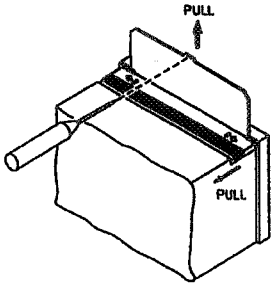
Instruments are designed according to below mentioned standards			Standards
Mounting angle	Standard : vertical (90 ± 5°) Other angles : specify angel to horsonal.  ⊥ vertical mounting ∠ 60° 60° to horizontal (e.g.) ⊓ horizontal mounting		DIN 16257
Measuring ranges	See technical specification DQ72-x		DIN 43701
Protection	Standard version	IP54 version *	*) Marked with label:"IP54 from font only when rubber gasket is mounted"
	From font	From rear	
(Housings)	IP52	IP52	
	Quadratic	Egdewise	IEC 529 and EN 60529
(Terminals)	IP20	IP100	
Climate	Class HUE Short-term condensing allowed.		DIN 40040
	Max. 95% RH at max. 25°C: max. 30 days per year		
	Max. 85% RH at max. 23°C: remaining days		
	Max. 75% RH at max. 21°C: average per year		
Temperature	-10...55°C (nominal) -25...60°C (operating) -25...65°C (storage)		En 60051 and IEC 51
Panel influence	The accuracy is affected neither by the material nor by the thickness of the panel.		En 60051 and IEC 51
Shock test	15g - 6 times - 3 directions		IEC 68-2-27, Test 1
Vibrations	3-13.2Hz: 3mm 13.2-100Hz: 1g		GL + LR: Test 1 DNV: Class A
Materials	All plastic materials are self-extinguishing.		UL94 (V0)
Test voltage	2kV - 50Hz - 1 min 3 kV - 50Hz - 1 min. for EQ72...144 - available on request.		EN 61010-1
EMC	CE classified for residential, commercial and light industry plus industrial environment.		EN 50081-1/2 and EN 50082-1/2
Safety	Quadratic instruments are supplied with protective cover fitted over terminals.		EN 61010-1 and IEC 1010-1

Hamworthy Moss AS

Part no: M0184-001 Item:

Exhange of scale - quadratic instruments

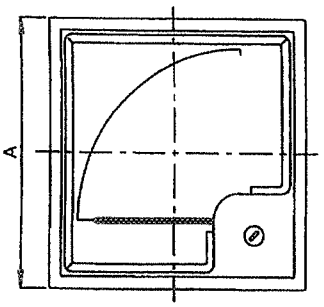


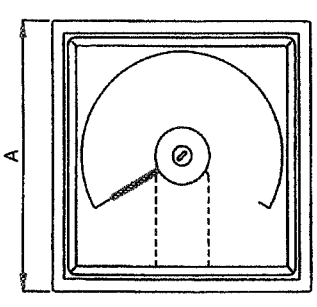


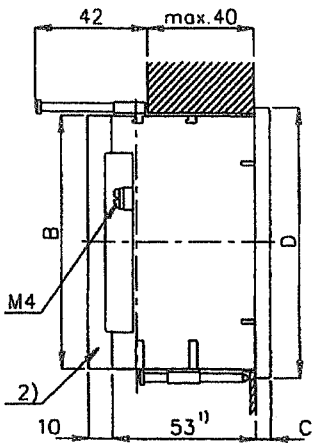
1. Press cover at top of instrument av shown.
2. Remove scale by means of a suitable tool (e.g screwdriver).
3. After exhange of scale: refit cover (press till it snaps into place).

Interrupt signal to terminals before exhanging the scale

Dimensional details - quadratic instruments (90° og 240°)







1. For range 15...40A = 59mm
2. Protective cover

90° moving coil	A	C	B	Panel cut - out	Weight (ca.)
Q72-x	72 x 72	5.5	66.5 x 66.5	68 x 68 +0.4	0.200kg

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Hamworthy Moss AS

Part no: M0121-001

FG : Item: 160

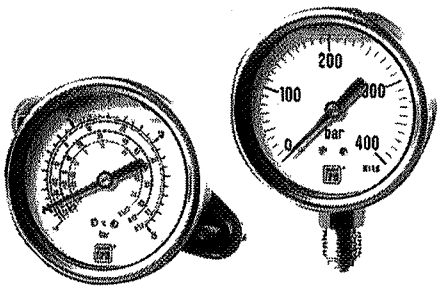
Rev: 02

Date: 20050527

PRESSURE GAUGE

Type 01.10.3.A - ø63

Range 0 - 10bar



01.10.3.A - ø63 Liquid filled

Type A:

Stem mounting;
lower connection

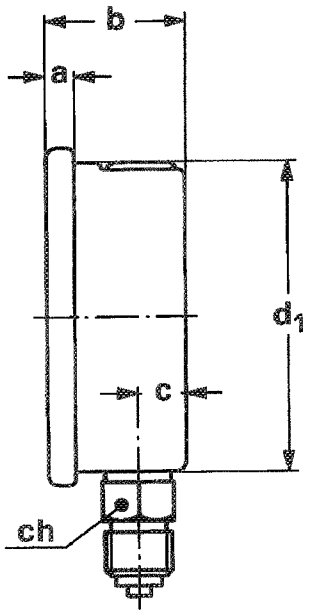
Range:

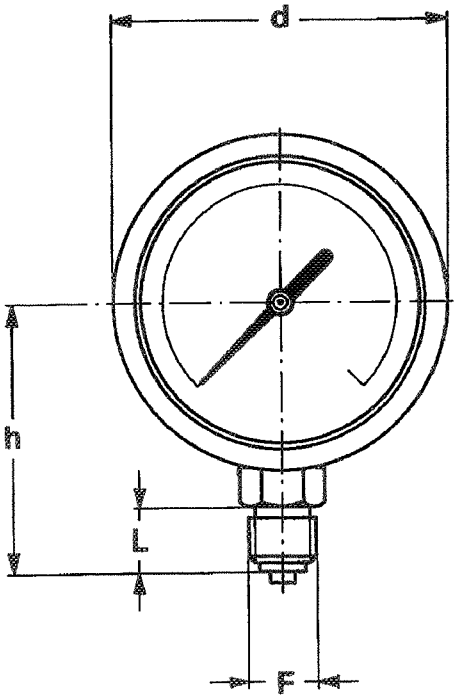
0 - 10bar; 0 - 1MPa

Connection:

1/4" BSP

DS	a	b	c	d	d1	F	L	ch	h
63	5,6	28	10	68	62,6	1/4" BSP	13	14 x 8	54,3





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Hamworthy Moss AS

Part no: M0120-001

FG: Item: 161, 163, 167

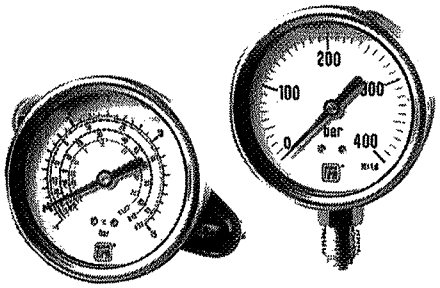
Rev: 01

Date: 20050527

PRESSURE GAUGE

Type 01.10.3.A - ø100

Range -0.4 / +0.6bar



01.18.3.A - ø100 Liquid filled

Type A:

Stem mounting;
lower connection

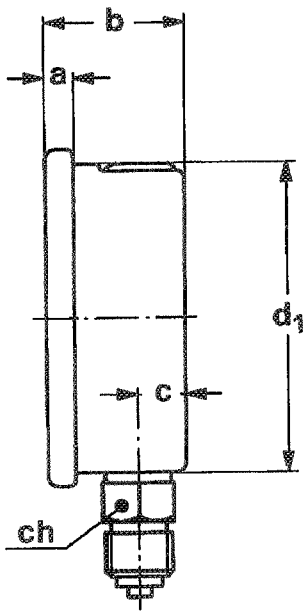
Range:

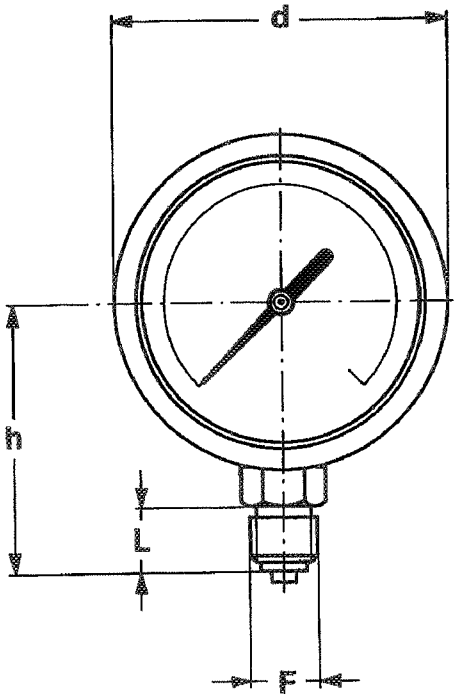
-0.4 / +0.6bar; -40 / +60kPa

Connection:

1/4" BSP

DS	a	b	c	d	d1	F	L	ch	h
100	13	48,6	16,1	110,6	101	1/4" BSP M	13	24	79





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Hamworthy Moss AS

Part no: M0117-001

FG: Item: 164164

Rev: 02

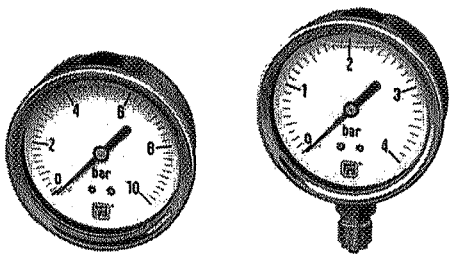
TG: 164

Date: 20050527

PRESSURE GAUGE

Type 01.18.3.A - ø63

Range 0 - 4bar



01.18.3.A - ø63 Liquid filled

Type A:

Stem mounting;
lower connection

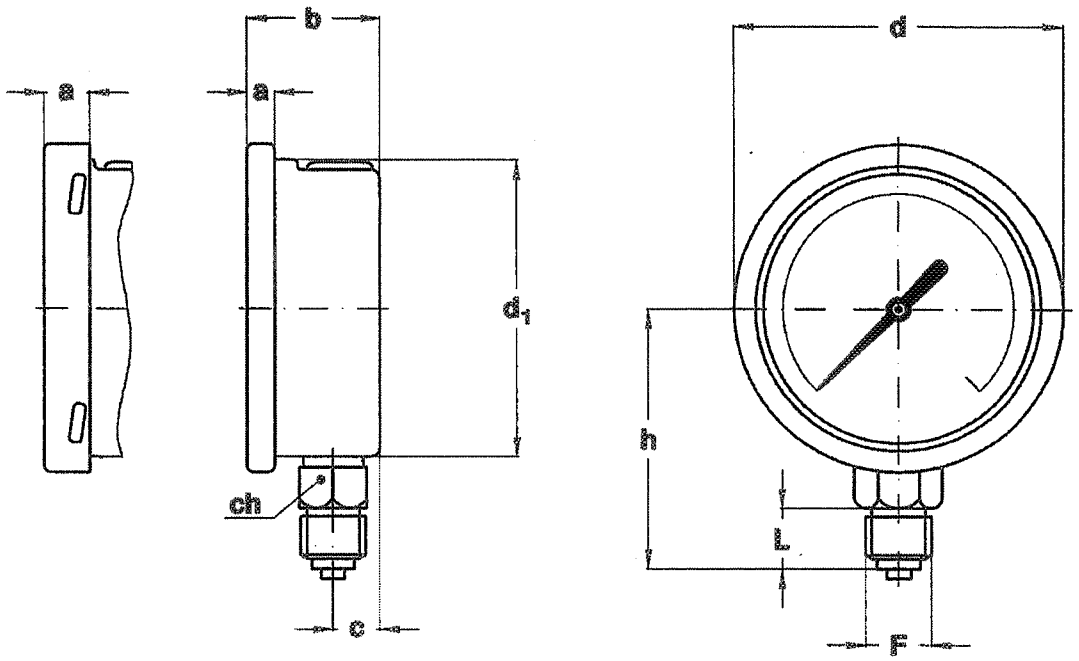
Range:

0 - 4bar; 0 - 400kPa

Connection:

1/4" BSP

DS	a	b	c	d	d1	F	L	ch	h
63	5,6	28	10	68	62,6	1/4" BSP	13	14 x 9	55,3



11-176

Hamworthy Moss AS

Part no: M0115-001

TG8 Item: 161, 162

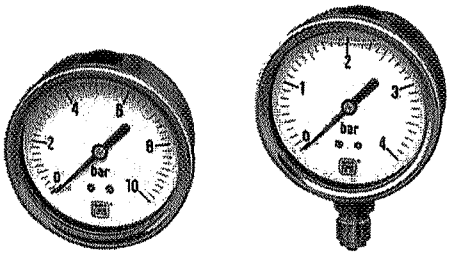
Rev: 01

Date: 20050527

PRESSURE GAUGE

Type 01.18.3.A - ø63

Range 0 - 1bar



01.18.3.A - ø63 Liquid filled

Type A:

Stem mounting;
lower connection

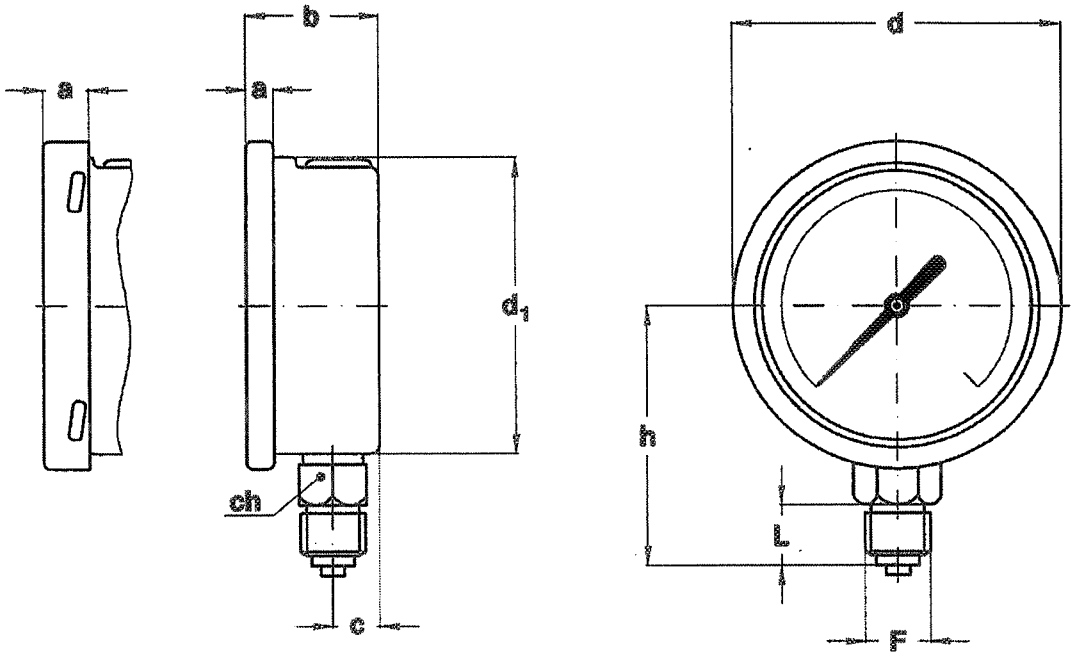
Range:

0 - 1bar; 0 - 100kPa

Connection:

1/4" BSP

DS	a	b	c	d	d1	F	L	ch	h
63	5,6	28	10	68	62,6	1/4" BSP	13	14 x 9	55,3



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Hamworthy Moss AS

Part no: M0119-001

TG% Item: 165

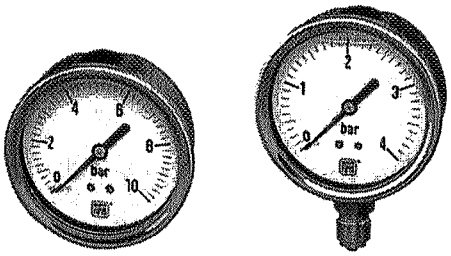
Rev: 01

Date: 20050527

PRESSURE GAUGE

Type 01.18.3.A - ø63

Range 0 - 40bar



01.18.3.A - ø63 Liquid filled

Type A:

Stem mounting;
lower connection

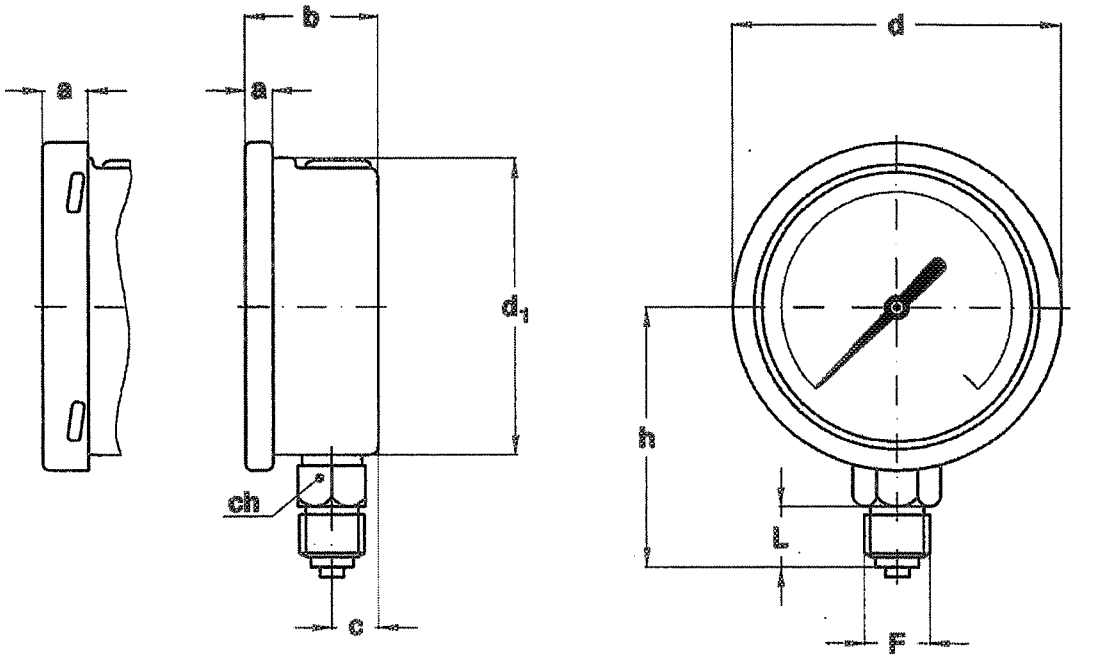
Range:

0 - 40bar; 0 - 4MPa

Connection:

1/4" BSP

DS	a	b	c	d	d1	F	L	ch	h
63	5,6	28	10	68	62,6	1/4" BSP	13	14 x 9	55,3



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Hamworthy Moss AS

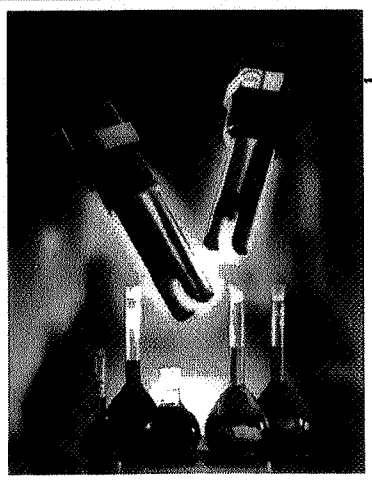
Part no: M0181-001

FG: Item: 193

Rev: 01

Date: 20050601

TG: 191, 193



LEVEL SWITCH

Type 003S

User manual

003 Integral sensor

- Self contained liquid level alarm
- No moving parts
- European Directive compliance

Features

- Relay or solid-state output
- Corrosion resistant PPS construction
- 1" or 3/4" threaded mounting
- Small in-tank dimensions
- 24V ac or dc powered
- Lightweight

Typical Applications

- Low level alarms in header tanks
- Pump control duty in feeder tanks
- High and low alarms in storage tanks
- Level and pump control in storage tanks
- Small or thin wall tanks

Installation

The 003 sensor may be mounted at any angle in the vessel, although care should be taken to ensure that the liquid is free to drain out of the sensor gap. Position the sensor away from entry or exit points to avoid areas of excessive turbulence or aeration, and avoid installation in the direct flow of liquid. Ensure a clearance of at least 25mm from all sensor surfaces to vessel wall to avoid forming air pockets or sludge traps. A threaded boss is recommended for pressurised applications. Refer to Installation leaflet for full details.

Description

Manufactured in Polyphenylene Sulphide (PPS) for corrosion resistance in most liquids, the 003 range of sensors can be mounted in any position in a tank using either a 1" or 3/4" thread available in BSPP, BSPT and NPT thread forms. A thread is provided on each side of a hexagonal boss to allow either external or internal / pole mounting of the sensor. Comprising a one piece moulded body with an integral pcb, the 003 switch is factory sealed and supplied with a 3m flying lead for customer connection. The 003 switch is designed for high or low level alarm duties to give a voltage free contact or solid state transistor output for alarm signalling or as part of a pump control system.

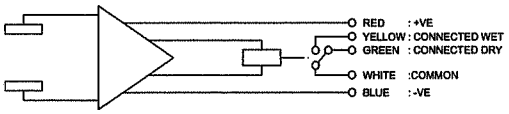
Operation

The moulded body contains two piezo-electric crystals, one each side of a gap at the tip of the sensor. An ultrasonic signal is transmitted from one crystal into the gap, but if there is air or gas in the sensor gap then the signal is not received by the other crystal. However, if there is a liquid present, the signal will be transmitted and the integral electronics will switch the output circuitry to signal the presence of a liquid.

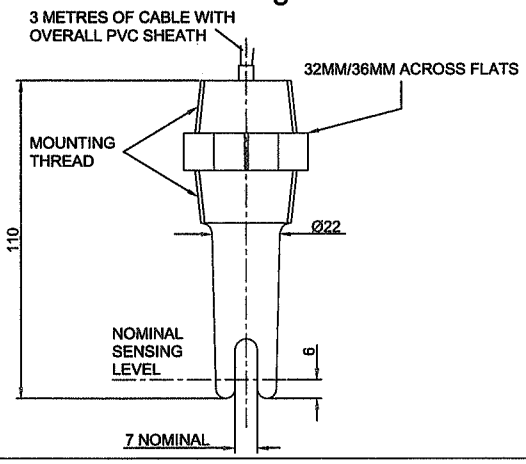
Hamworthy Moss AS

Part no: M0181-001 Item:

Schematic: 003S models



Dimensional drawing



RELAY OUTPUT MODELS

Code	Description			
003	Integral ultrasonic level sensor, polyphenylene sulphide construction			
	Code	Output type		
	S	Integral SPCO relay, energised when sensor wet		
		Code	Mounting thread	Max pressure 20O 70°C
		0	¾" BSPT dual	20 bar 20 bar
		2	1" BSPT dual	20 bar 20 bar
		5	1" NPT dua	20 ba 20 bar

003	S	2	Typical model number

Technical specification

	003S* models
Operating pressure	20 bar
Operating temperature	-20°C to + 70°C
Ambient temperature	As operating temp.
Minimum S. G.	0.50
Max. viscosity	5000cSt. at 20°C
Switching response	50ms dry-wet
	0.5s wet-dry
Hysteresis	< 4mm
Repeatability	+/- 2mm
Overall length	110mm
Length into tank	79mm (External mount)
Body diameter	22mm
Switching function	SPCO relay(energised wet)
Maximum switched current	1A at 30v res. 0.25A at 30v ind.
Maximum switched voltage	30v
Power supply	18-30v dc or ac
Dry current drawn	10mA nom.
Wet current drawn	25mA max.
Cable length	3m: 5 core 7/0.2mm
Cable sheathing	PVC
IP rating of sensor	IP66/IP68 (3m)
Not suitable for use in intrinsically safe circuits. Not suitable for the direct starting of large motors.	

Hamworthy Moss AS

Part no: M0182-002 FG:Item: 194

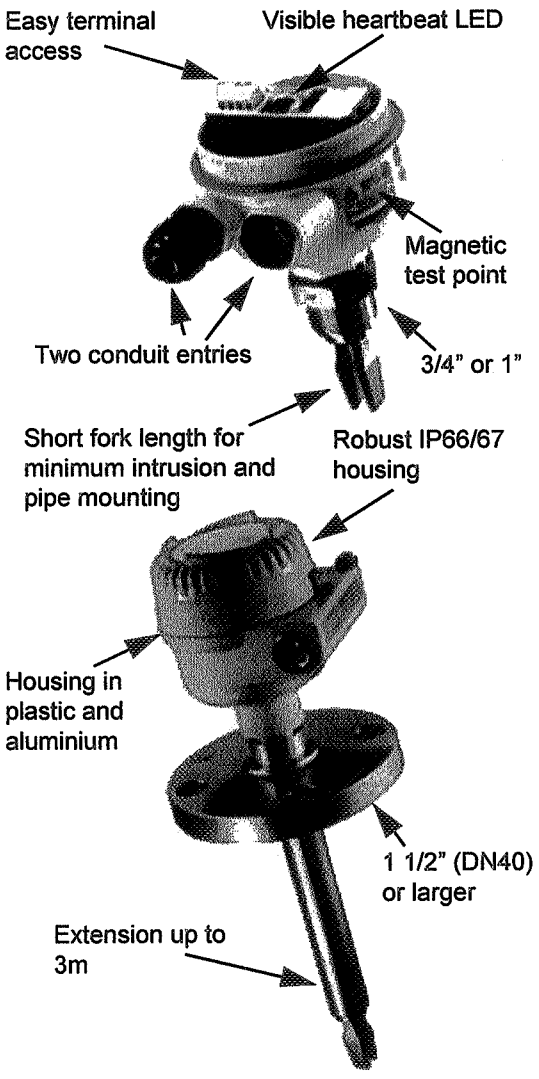
Rev: 01 Date: 20050601

LEVEL SWITCH

Squing 2

User manual

Squing-2 vibrating fork level switch



Squing 2 is a liquid level switch designed using the principle of a tuning fork. By using piezo-electric crystals the Squing 2 fork is forced to resonate constantly at its natural frequency.

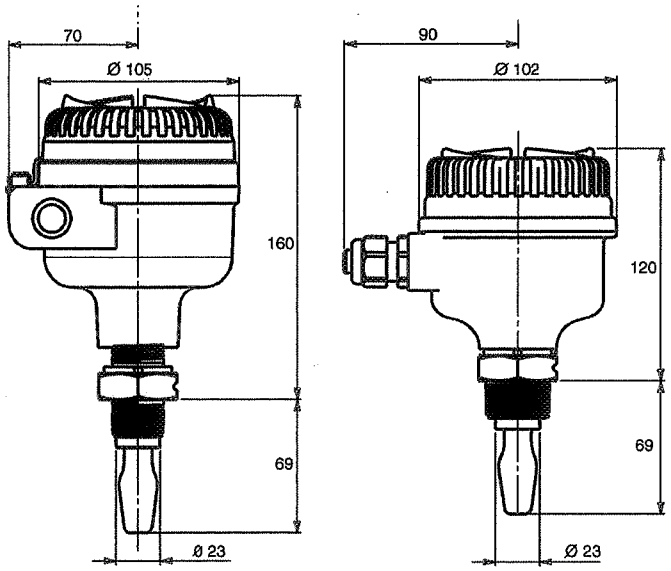
When installed as a **high alarm**, a rising liquid will come into contact with the forks and dampen them, changing this natural resonant frequency; from this the electronics make the output of Squing 2 change. Or, when installing the Squing 2 as a **low alarm** the fork is normally submerged; as your liquid level lowers past the forks there is a change in their frequency and again the electronics make the output change.

Features

- 316L Stainless steel as standard
- Hastelloy C and ECTFE (Halar)/PFA coating options
- Continuous operating temperature 150×C and pressure to 100 bar g
- Choice of industry standard flanges
- Complete range of electronics
- Protection against reverse polarity and short circuit connection
- No mechanical moving parts - maintenance free
- Resistant to plant vibration

Part no: M0182-002 Item:

Dimensional drawings (in mm):



Applications

Overfill protection

Spillage caused by overfilling can be hazardous to the environment and people, results in lost product and incurring costs of clean up operations. Squing 2 is a failsafe limit level switch with built-in highly visible Îheartbeat LEDÌ to reassure you that it is always ready to detect and signal overfill at any time.

Provided as standard, the magnetic test point on the unit allows for simple onsite functional test providing re-assurance of operation without removing the unit from your tank.

Limit detection

Often batch processing tanks contain stirrers/ agitators to ensure the mixing and product "fluidity". With the standard user selectable time delay from 0.3 to 30 seconds, there is no chance of false switching due to splashing caused by stirrers/agitators.

A choice from a range of different electronics provides the benefit of trouble-free integration into your existing system especially as existing wiring can be utilised.

Pipe installation (pump protection)

Short forks for minimum intrusion wetside allows simple low cost installation at any angle into your pipes or vessels. With the forkÌs projecting in only 69mm, the Squing 2 can be installed in small diameter pipes. By selecting the option of direct load switching electronics, Squing 2 is ideal for reliable pump control and can be used to protect against pump dry running. With a range of housings types rated IP66/67 the Squing 2 can be installed in almost any environment.

High and low level alarm

Maximum and minimum detection in tanks containing many types of liquid is measured using Squing 2. The robust Squing 2 operates continuously at temperatures up to 1500C and operating pressure to 100 bar g making it perfect for use as a high or low level alarm. Available with industry standard flanges to ANSI and BS standards from stock, or other international standards to order and with forks constructed in various materials such as stainless steel, Hastelloy C, or with ECTFE (halar)/PFA coatings.

Hygenic applications

With the option of highly polished forks with a surface finish (Ra) better than 0.8µm, the Squing 2 meets the principle design criteria of 3A and EHEDG for equipment used in the manufacture of hygienic applications like food, beverage, and pharmaceutical. Manufactured in Stainless Steel the Squing 2 is robust enough to withstand steam cleaning (CIP) routines at temperatures up to 1500C. Working in viscous liquids and liq-

uids with high solids content, the Squing 2 will ignore low/medium density foams and aeration.

Specifications

Construction

Housing/Enclosure	Aluminium (also for explosion proof); Flame retardant plastic; Plastic
Threaded connections	R 3/4" and 1" (BSPT); G 3/4" and 1" (BSPP); 3/4" and 1" NPT
Hygienic connections	TriClover, SMS, BSPP flush mount, Tuchenhagen, DIN 11851
	Flanges to ANSI B16.5 (1.5Ó or larger) and BS4504 (DN40 or larger)
Extended lengths	Available to max 3m.

Operating conditions

Wetside temperature range	-40°C to +150°C
CIP cleaning	10,000 cycles up to 130°C for 30 minutes.
Ambient temperature range	-40°C to +80°C (derated to 50°C at 150°C wetside)
Wetside pressure range	Wetside pressure range -0.25 bar g to +100 bar g at 50°C
Liquid Specific gravity range	0.6 to 2.0
Liquid viscosity range	0.2 to 10,000 cps
Switching point (water)	13mm from tip (vertical) / from edge (horizontal) of fork
Hysteresis (water)	+/- 1mm nom.
Switching delay	User selectable 0.3, 1, 3, 10, 30 seconds delay dry to wet / wet to dry.

Electrical connections

	24 to 264V ac/dc, 50/60Hz, direct load switching (two wire)
	24 to 60V dc solid state PNP output for direct interface to PLCÌs (three wire)
	SPCO single relay for voltage free contacts

Approvals/certificates

E.M.C. Directive	EN61326 Emissions to Class B. Immunity to industrial location requirements
L.V. Directive	EN61010-1 Pollution degree 2, Category II (264V max)
	Pollution degree 2, Category III (150V max)
Pending	FM Explosion proof, non incendive
	CSA general purpose, explosion proof
	ATEX (EEx d) II 1/2 G

Hamworthy Moss AS

Part no: M0182-002inst Item: 194

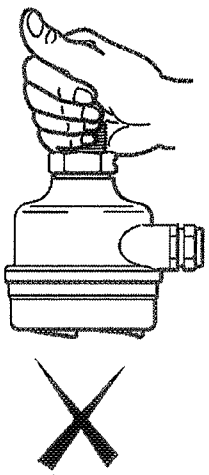
Rev: 00 Date: 20071214

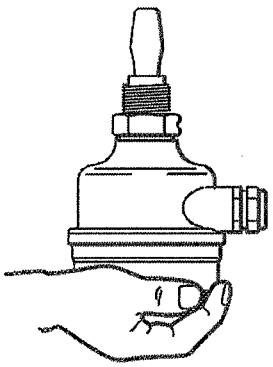
LEVEL SWITCH

Squing 2

Handeling and installation

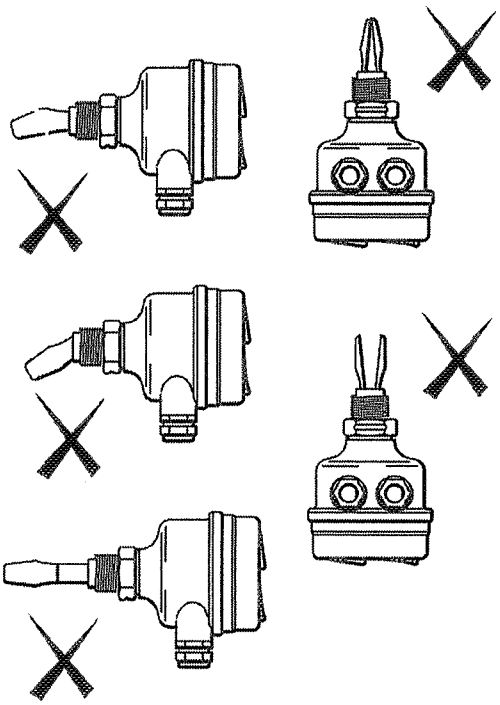
Do not hold the level switch by forks!





OK

Do not alter the level switch in any way!



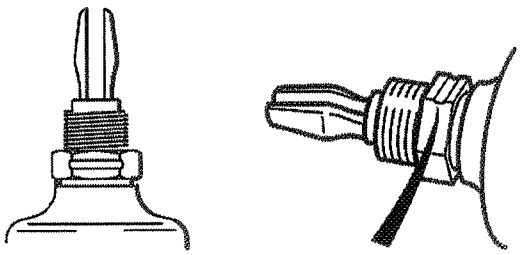
11-184

Hamworthy Moss AS

Part no: M0182-002inst Item:

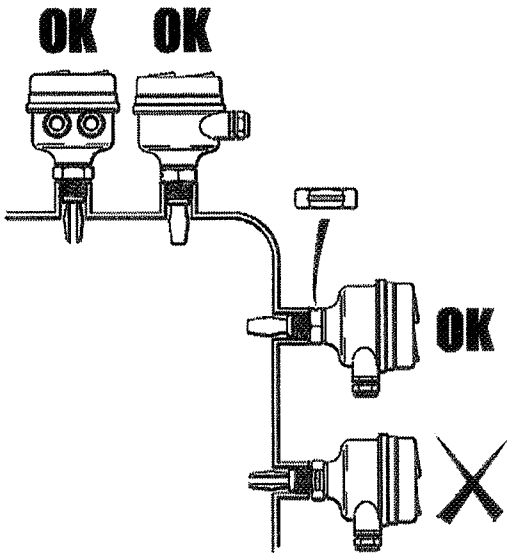
Installation

Correct for allgnment

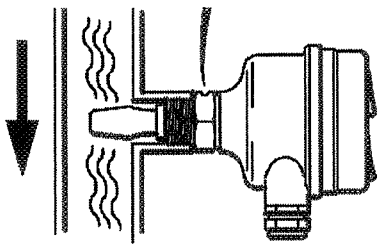


Alignment groove

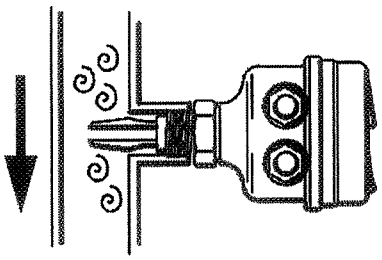
Note!



Note!



OK



11 - 185

Hamworthy Moss AS

Part no: M0169-001

FG: Item: 164, 189

TG: 184

Rev: 01

Date: 20050601

PRESSURE SWITCH

Singel switch point

Type P1H - B30 - SS

Technical data

- Temperature range: -30°C up to + 75°C.
- Pressure connection:1/4" NPT female thread.
- Electrical connection: Screw terminals and cable gland PG 13,5.
- Electrical characteristics:

  B - microswitch: 125...480 V ~: 10 A,
  6...12 V = : 15 A, 24 V =: 6 A

- Type of protection: IP 65
- Instrinsically safe operation: The switches are intrinsically safe models, EEx ia IIC according to INIEX 88.B 101.106.U. (CENELEC). Order suffix: *-Exi.* With these switches the following max. values must be adhered to:

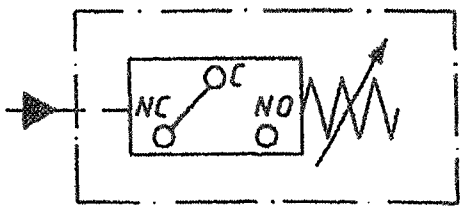
  Max. voltage = 28 V
  Max. current = 50 mA

- Adjustment instructions for pressure: Release cap screw. Turn the adjustment screw clockwise to increase the set point and vica versa. Tighten cap screw after set point adjustment.
- Weight : Appr. 1,2 kg

Part no.: P1H - B30 - SS

- P = Type of pressure switch
- 1 = Number of set points. Single Switch point.
- H = Type of housing. Weather-proof housing.
- B = Type of microswitch. Standard type B.
- 30 = Adjustable range
- SS = Material of wetted parts. Fitting 17-7PH stainless steel. Diaphragm: Buna N.

Wiring diagram

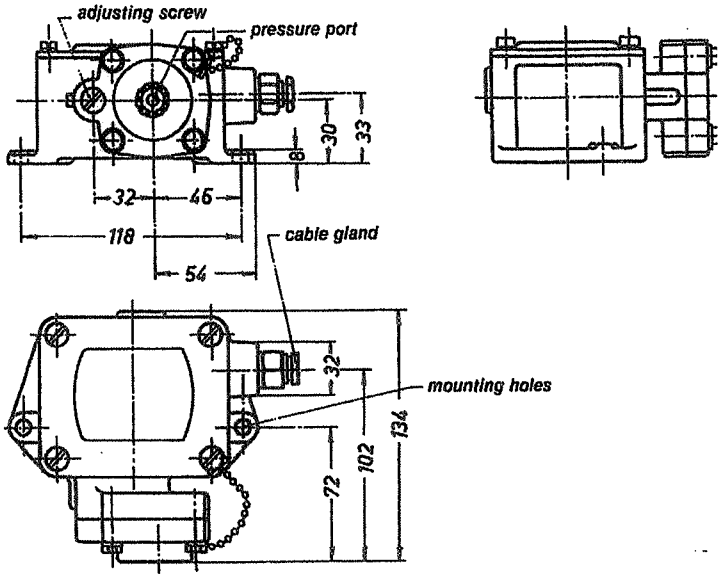


11 - 186

Hamworthy Moss AS

Part no: M0169-001 Item:

Drawing of P1H - single switch



Pressure switches - all values given in bar

Single switch point	Proof pressure	Decreasing pressure (bar)		Increasing pressure (bar)		Max. hysteresis
P1H-B30SS	137	Min.	Max.	Min.	Max.	0,14
		0,035	1,90	0,100	2,05	

Microswitches

All switches use microswitches with silver-contacts. It is occasionally necessary to use gold-contacts. A guideline as to which contacts should be used the following may be of assistanse:

Voltage > 24 V (independent of current) : silver-contacts microswitches.

Current > 100 mA (independent of voltage): silver-contacts microswitches.

Voltage ≤ 24 V and current ≤ 100 mA : gold-contact microswitches.

Hamworthy Moss AS

Part no: M0167-001

FG: Item: 187

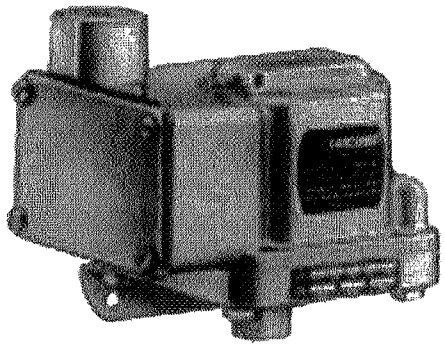
Rev: 01

Date: 20050601

PRESSURE SWITCH

Type D1T-M3-SS-Exi

Pressure range -0.2 / +0.2bar



Technical data

- Temperature range: -55°C up to +75°C.
- Pressure connection: 1/4" NPT female thread.
- Electrical connection: Covered terminal block and cable gland PG 13.5.
- Electrical characteristics:

  M - microswitch 125...250 V ~: 10 A, 480 V ~: 3 A, 6...12 V = : 15,0 A, 24 V = : 2,0 A

- Protection: IP 65
- Intrinsically safe operation: The switches are an intrinsically safe model EEx ia IIC according to INIEX 88.B 101.106.U. (CENELEC), order suffix: *-Exi.* With these switches follow the values below:

  Max voltage = 28 V
  Max current = 50 mA

- Adjustment instructions:

1. Pressure: turn the self locking adjustment screw clockwise to decrease the set point and vica versa.
2. Vacuum: turn the self locking adjustment screw counter-clockwise to increase the set point from vacuum to atmospheric pressure and vica versa.

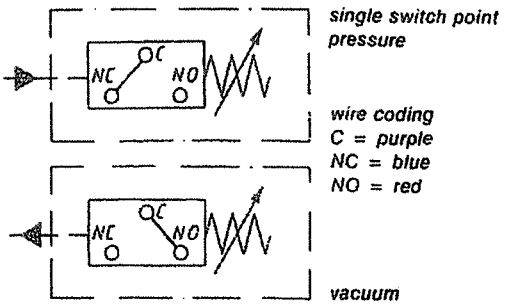
- Weight: appr. 1,0 kg

Part no.: D1T - M3 - SS - Exi

- D = Type
- 1 = Number of set points. Singel switch point.
- T = Type of housing. Weather-proof housing with terminal block and tamper-proof external adjustment.
- M = Type of microswitch. M standardtype
- 3 = Adjustable range
- SS = Material of wetted parts. Fitting and diaphragm: 17-7PH, stainless steel.

Wiring diagram

wiring diagram:



single switch point pressure

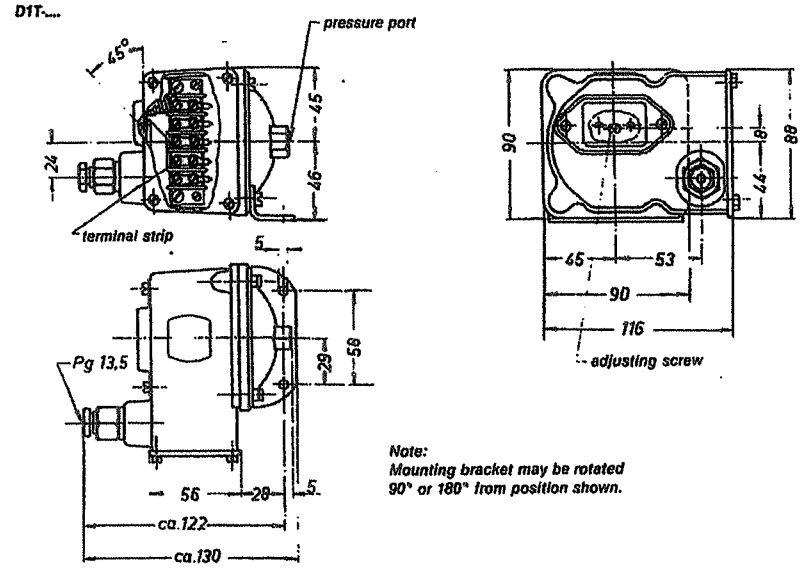
wire coding
C = purple
NC = blue
NO = red

vacuum

Hamworthy Moss AS

Part no: M0167-001 Item:

Drawings of D1T



Pressure switches - all values given in bar

Singel switch point	Proof pressure (bar)	Decreasing pressure (bar)		Increasing pressure (bar)		Max. hysteresis (bar)
D1T-M3-SS	0,6	Min.	Max.	Min.	Max.	0,010
		0,002	0,20	0,012	0,20	

Vacuum switches - all values given in vacuum bar

Singel switch point	Proof vacuum	Decreasing vacuum		Increasing vacuum		Max. hysteresis
D1T-M3SS	0,2	Min.	Max.	Min.	Max.	0,010
		0,002	0,2	0,01	0,2	

Microswitches

All switches use microswitches with silver-contacts. It is occasionally necessary to use gold-contacts. A guidline as to which contacts should be used the following may be of assistanse:

Voltage > 24 V (independent of current): silver-contact microswitches.

Current > 100 mA (independent of voltage): silver- contact microswitches.

Voltage ≤ 24 V and current ≤ 100 mA: gold - contact microswitches.

Hamworthy Moss AS

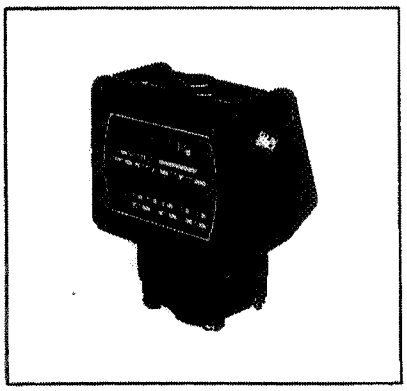
Part no: M0168-001 TG: Item: 181

Rev: 01 Date: 20050601

PRESSURE SWITCH

D2T-M18SS-Exi

Technical data:	
Temperature range:	−30 °C up to +75 °C
Pressure connection:	1/4" NPT female thread (1/2" NPT female thread optional with SS, order suffix: -P2, for example: P1H-B8SSS-P2)
Electrical connection:	screw terminals and cable gland PG 13,5
Electrical characteristics:	B-microswitch 125...480 V~: 10 A, 6...12 V⎓: 15 A, 24 V⎓: 6 A H-microswitch 125...250 V~: 10 A, 480 V~: 3 A, 6...28 V⎓: 0,5 A K-microswitch 125...480 V~: 10 A, 6...12 V⎓: 15 A, 24 V⎓: 6 A J-microswitch 125...250 V~: 10 A, 480 V~: 3 A, 6...28 V⎓: 0,5 A
Type of protection:	IP 65
Intrinsically safe operation:	The switches are also available as an intrinsically safe model EEx ia IIC according to INIEX 99.B 101.106.U. (CENELEC) order suffix: -Exi for example: P1H-B8SSS-Exi Using these switches the following max. values must be adhered to: Max. voltage = 28 V Max. current = 50 mA



Adjustment instructions:	Pressure: Release cap screw. Turn the adjustment screw clockwise to increase the set point and vice versa. Tighten cap screw after set point adjustment.
Weight:	appr. 1,2 kg

Options see page 11

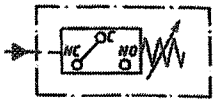
Typical part no.:

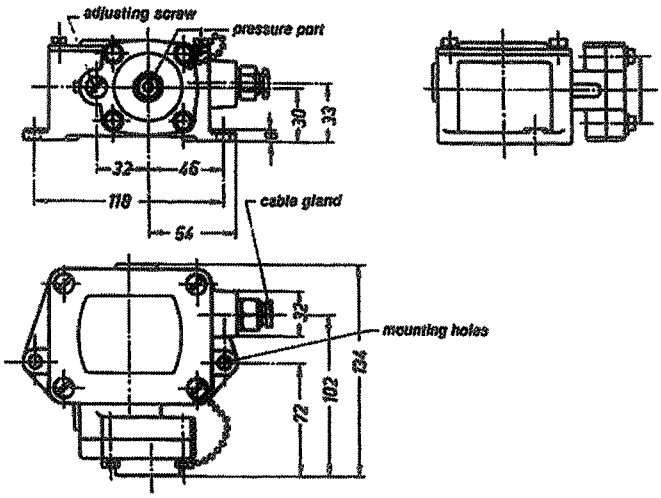
P 1 H-B 8S SS

- Type
- Number of set points: 1: single switch point
- Type of housing: H: weather-proof housing
- Type of microswitch: Standard: type B and type H or type J and type K (humidity protected)
- Adjustable range
- Material of wetted parts: No suffix: Fitting: Nickel-plated aluminium Diaphragm: Buna N; SS: Fitting: 17-7PH stainless steel Diaphragm: Buna N

Part no: M0168-001 Item: 181

Wiring diagram:





Microswitches

All switches use microswitches with silver-contacts. It is occasionally necessary to use gold-contacts. A guideline as to which contacts should be used the following may be of assistance:
Voltage >24 V (independent of current): silver-contact microswitches
Current >100 mA (independent of voltage): silver-contact microswitches
Voltage ≤24 V and current ≤100 mA: gold-contact microswitches.
For further details please contact factory.

Pressure switches — All values given in bar (gauge)
Models with B- or H-microswitch

Part no. according to the material of wetted parts		proof pressure	adjustable range pressure decreasing min.	pressure decreasing max.	pressure increasing min.	pressure increasing max.	max. hysteresis
P1H-B30	P1H-B30SS	137	0,035	1,90	0,100	2,05	0,14
P1H-B85	P1H-B85SS	137	0,210	5,35	0,310	5,85	0,49
P1H-B340	P1H-B340SS	137	0,415	21,90	0,690	23,40	1,52
P1H-H600	P1H-H600SS	137	1,720	40,20	1,860	41,35	1,17

Pressure switches — All values given in bar (gauge)
Models with J- or K-microswitch (humidity protected)

Part no. according to the material of wetted parts		proof pressure	adjustable range pressure decreasing min.	pressure decreasing max.	pressure increasing min.	pressure increasing max.	max. hysteresis
P1H-K30	P1H-K30SS	137	0,035	1,90	0,100	2,05	0,14
P1H-K85	P1H-K85SS	137	0,210	5,35	0,310	5,85	0,49
P1H-K340	P1H-K340SS	137	0,415	21,90	0,690	23,40	1,52
P1H-K1600	P1H-K1600SS	137	27,6	102	38,2	110	8,62
P1H-J600	P1H-J600SS	137	1,720	40,20	1,860	41,35	1,17
P1H-J1600	P1H-J1600SS	137	27,6	104	33,1	110	5,52

Hamworthy Moss AS

Part no: M0165-001

FG° Item: 183

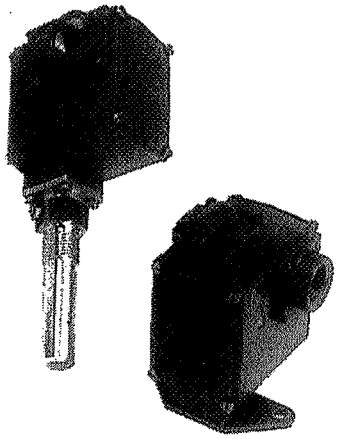
Rev: 01

Date: 20050527

PRESSURE SWITCH

Model 4140C

Type K1E12 AA0-EE



Features

- Single step pressure switch with one micro-switch for one pressure setpoint.
- Housing: Diecast aluminium alloy casting with high resistance to corrosion. Removable covers at front and rear for easy access to setpoint adjustment and microswitch terminals. Fully gasketed and weatherproof to IP56.
- Vibration: Vibration resistant up to 4G/100 Hz.
- Ambient temperature: Suitable for installation in ambients of -15 to +90°C (+5 to +194°F). The setpoint varies by less than 1% for a variation of 0-80°C (32-176°F) of ambient temperature.
- Finish: Standard finish is light grey enamel paint. For installation where salt corrosion is anticipated and for salt water sensing applications, a corrosion protection finish (i.e. aluminium parts anodised before painting and fitting an Aluminium Bronze pressure bonnet) can be provided.
- Pressure sensing: Nitril rubber diaphragm (BUNA-N) with support ring fitted to aluminium or aluminium bronze pressure chamber. Maximum permitted temperature, 90°C (194°F). Suitable for oil, water, air and gas sensing. When sensing sea water pressures, specify corrosion protected model which provides for an aluminium bronze pressure bonnet.
- Manual override: Optional feature. A manually operated push-button can be provided to mechanically override the setpoint during equipment start-up operations. Once start is achieved, sensed pressure when slightly above the pressure setpoint, releases the override allowing the switch to function normally if pressure falls.
- Setpoint indication: Pressure switches are equipped with a scale plate, calibrated in Bar pressure unit appropriate to the pressure range and microswitch type specified.

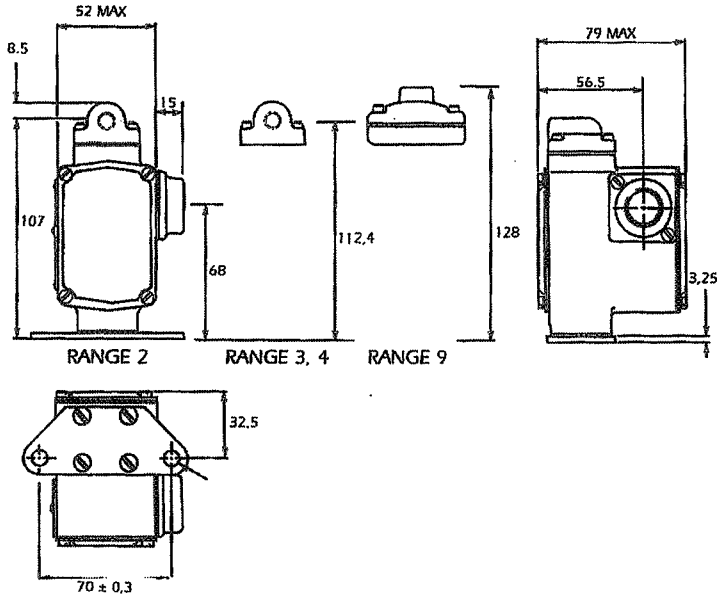
Technical spesification -

4140C K1E12 AA0-EE

- Basic model, *Code C* : Singel Step Pressure.
- Microswitch type, *Code K* : Low Reset Differential 4G at 100 Hz.
- Finish, *Code 1* : Standard
- Conduit thread, *Code E* : PG 13,5.
- Pressure connection, *Code 1* : 1/8" BSPTr
- Pressure ranges in Bar (Minimum falling; Maximum rising), *Code 2* : 3,45 - 6,9. (50 - 121 PSI)
- Temperature stem length, *Code A* : Pressure switch.
- Temperature stem adaptor, *Code A* : No adaptor, fitted/pressure switch.
- Temperature range (deg. C rising), *Code 0*: Pressure switch.
- *Code EE* - no special requirements.

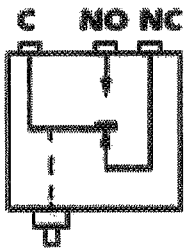
Hamworthy Moss AS

Part no: M0165-001 Item:



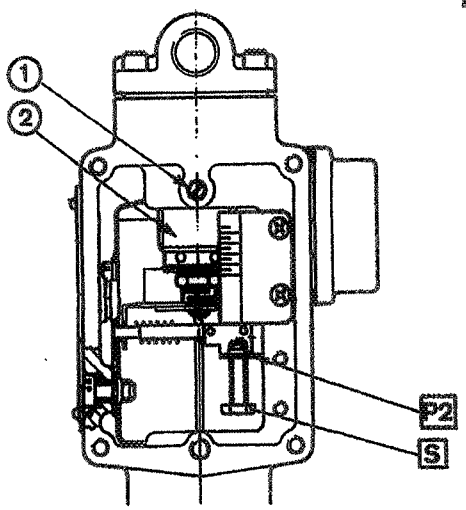
Microswitch details

Type K, R & S



The following table details max. currents for the standard Type K microswitch:

Voltage	AC		DC	
	resesitive	inductive	resesitive	inductive
15			15,0	10,0
30			5,0	5,0
50			1,25	1,25
75			0,75	0,75
125	15,0	15,0	0,50	0,05
250	15,0	15,0	0,25	0,03
380	15,0	5,0		
480	15,0	5,0		



Remove the front cover, slacken off the locking screw (1) and rotate the brass adjusting barrel using a tommy bar located in holes in the circumference (2). The pressure setpoint can be read from the calibrated pressure scale plate at a point adjacent to the black line circling the pressure adjusting barrel. Retighten the locking screw.

Hamworthy Moss AS

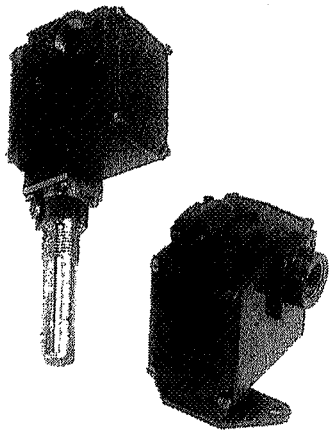
Part no: M0166-001 TG: Item: 185

Rev: 01 Date: 20050527

PRESSURE SWITCH

Model 4140C

Type K1E13 AA0-EE



SPECIFICATIONS

Materials of construction	
Housing	* Diecast Aluminium alloy casting. * Fully gasketed and weather-proof
Finish	* Epoxy polyester powder coating.
Pressure Chamber	* Fitted with Nitrile rubber diaphragm.
Temperature Sensing Probe	* Wax element enclosed in Copper sheath or bi-metalic disc

Vibration * Resistant up to 14G/ 100Hz
(refer to microswitch type)

Temperature * -40C to + 120C ambient (-40F to + 248F)

Types * Singel - pressure
* Dual
* Combine pressure and temperature

Set Point Indication * clear visibility on scale plate.

Microswitch * 15A resistive at 15V d.c

Current Rating * 0,5A resistive at 250V d.c
* 15A resistive at 15V d.c
* 15Aresistive at 15V d.c

Cable Entry * Side fitments PG 13.5 thread standar (for options refer to model code)

Pressure Sensing * 0.28 to 40 bar (4 to 580 psi)

Ranges 6.89 - 23.44 BAR 100-580 PSI

Temerature Sensing
* 16GC to 250C (61F to 485F)

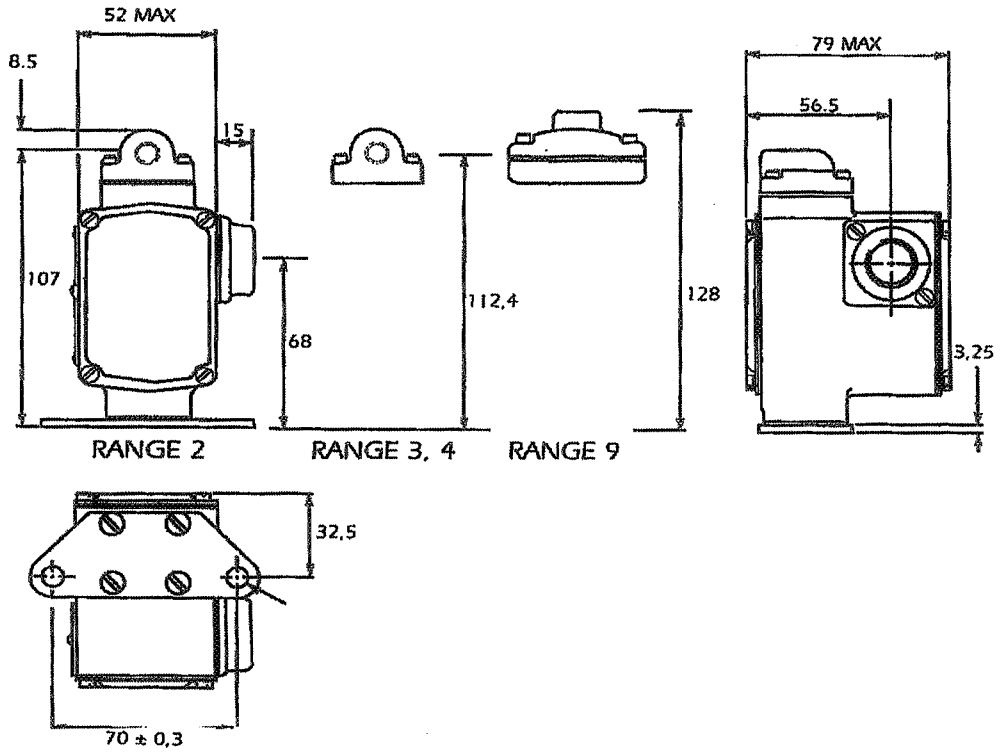
Marine Classification Information

In accordance with the Classification Societies Rules a Thermoeell must be used on all Temperature Switch installations for liquid sensing, in marine applications.

The following have been Type Approved for marine applications
Pressure ranges : 1,2,3,4,9
Temperature ranges : 1,2,3.4 & 5
Microswitch types : K,R,S

Hamworthy Moss AS

Part no: M0166-001 Item:



MODEL 4140 C K 1 D 13A A 0 - EE No Special Requirements

Basec Model - 4140 - Single Step Pressure Code C

Microswitch Type - Low Reset Differential/4g af 11Hz Code K

Finish - Sandard Code 1

Pressure Connection - 1/8" BSPTr Standar 1

Pressure Ranges BAR - 6.89 - 23.44 Bar 100 - 340 PSI Code 3

Temperature Stem Length - Pressure Switch Code A

Temperature Stem Adaptor - No Adaptor Fitted/Pressur Switch.Code A

- **Temperature Range** - Pressure Switch code 0

Hamworthy Moss AS

Part no: M0164-001

FG: Item: 192

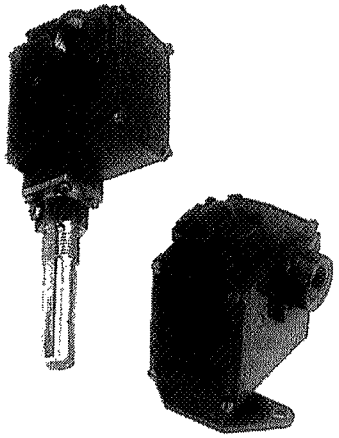
Rev: 01

Date: 20050527

TEMPERATURE SWITCH

Model 4140D

Type K1E00CE2-EE



Features

- Single step temperature.
- Switch with one microswitch for one temperature setpoint.
- Housing: Diecast aluminium alloy casting with high resistance to corrosion. Removable covers at front and rear for easy access to setpoint adjustment and microswitch terminals. Fully gasketed and weatherproof to IP56.
- Vibration: Vibration resistant up to 4G/ 100Hz.
- Ambient temperature: Suitable for installation in ambients of -15 to +120°C (+5 to 248°F). The setpoint varies by less than 1% for a variation of 0 - 80°C (32 - 176°F) of ambient temperature.
- Finish: Standard finish is light grey enamel paint. For installation where salt air corrosion is anticipated, a corrosion protective finish (i.e. aluminium parts anodised before painting) can be provided.
- Setpoint indication: Temperature switches are equipped with a scaleplate, calibrated in °C, appropriate to the temperature range specified.

Setpoint adjustment

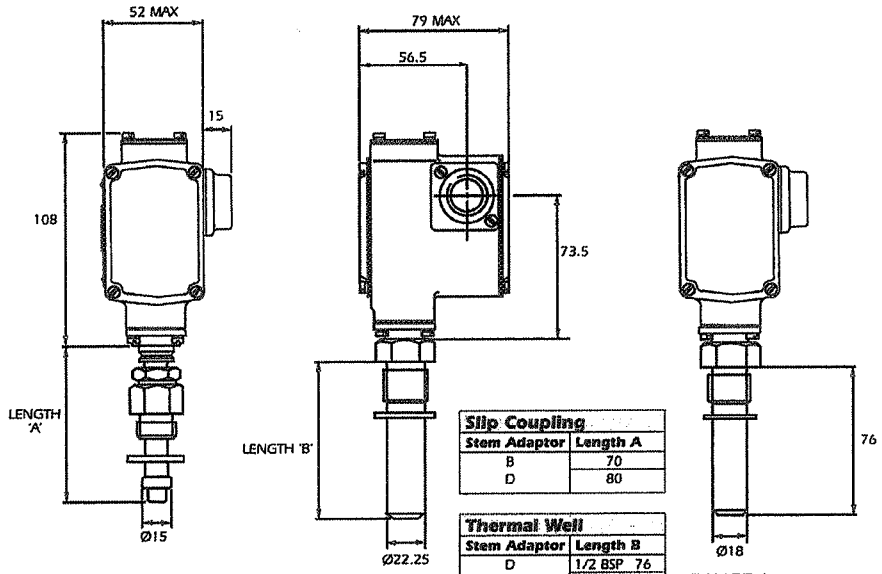
Remove the front cover, slacken off the locking screw (1) and rotate the brass adjusting barrel using a tommy bar located in holes in the circumference (2). The temperature setpoint can be read from the calibrated temperature scale plate at a point adjacent to the black line circling the pressure adjusting barrel. Retighten the locking screw.

Technical specification - 4140D K1E00CE2-EE

- Basic model, *Code D :* Single Step Temperature.
- Microswitch type, *Code K :* Low Reset Differensial 4G at 100 Hz.
- Finish, *Code 1 :* Standard.
- Conduit thread, *Code E :* Standard PG 13,5.
- Pressure Connection, *Code 0* : Temperature switch.
- Pressure ranges in bar (minimum falling; maximum rising, *Code 0 :* Temperature switch.
- Temperature stem length, *Code C :* 80 mm.
- Temperature adaptor, *Code E* : Thermowell 1/2" BSPPL, Aluminium bronze. Max. pressure (bar) : 105.

Hamworthy Moss AS

Part no: M0164-001 Item:



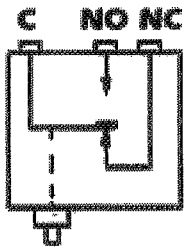
Slip Coupling	
Stem Adaptor	Length A
B	70
D	80

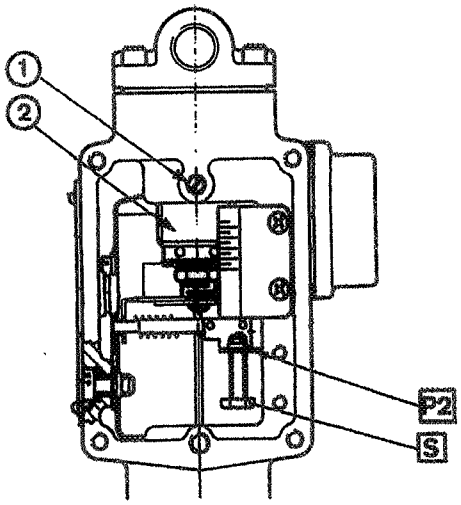
Thermal Well	
Stem Adaptor	Length B
D	1/2 BSP 76
	3/4 BSP 81
E	40

- Temperature range (°C rising), *Code 2 :* 49 - 71°C.
  Code EE : No special requirements.

Microswitch details

Type K, R & S





The following table details max. currents for the standard Type K microswitch:

Voltage	AC		DC	
	resesitive	inductive	resesitive	inductive

11 - 197

Hamworthy Moss AS

Part no: M0164-001 Item:

Voltage	AC		DC	
15			15,0	10,0
30			5,0	5,0
50			1,25	1,25
75			0,75	0,75
125	15,0	15,0	0,50	0,05
250	15,0	15,0	0,25	0,03
380	15,0	5,0		
480	15,0	5,0		

Hamworthy Moss AS

Part no: M0086-001 TG: Item: 200

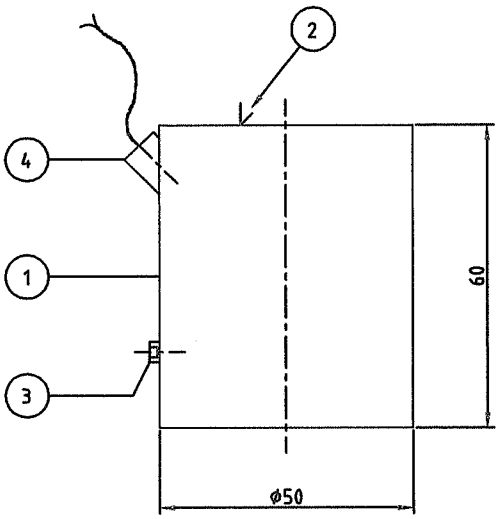
Rev: 02

Date: 20061207

BURNER FLAME

Flame Scanner complete

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.



CODE No.: M0086-001

Ant. pr. enhet	Pos.	Navn, type, dimensjon.	Matriale	Vekt	Best. fra	Kode. nr. Code No.
	5					
1	4	PHOTO CELL				M0232-001
1	3	FIX SCREW				
1	2	FIX SCREW				
1	1	BODY				

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Dato Date	Skala Scale	Gruppe nr. Group. No.
MOSS STANDARD		[signature]	BT	[signature]	[signature]	20000619	1:1	6400

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Title: INERT GAS SYSTEM

BURNER FLAME SCANNER

Erstn. for Replacec: A4-7932

Erstattet av Replaced by

Hamworthy KSE a.s, Moss Liquid Cargo Handling

M3921-002std Rev. 00

Side Sheet 1 av of 1 sider sheets Format A4

Forandringen REV 00) 20000619/ [signature] UPDATED TO JEEVES

11-199

Part no: M0086-001 Item:

Description of flame amplifier PR 2271 R2B2

The flame amplifier is built up around a microprocessor core. The input is sensitive to variations of resistance in the photo-resistor (LDS) caused by variations in the flame brightness. Range of variations: 0 - 10kΩ .

Power supply is 24V DC plus/minus 20%.

The electrical circuit operates a relay, rating max. load at 24V DC: 1A.

A red LED in front is lit when the amplifier is registering a flame.

An information for flame scanner amplifier adjustment

The flame scanner consists of a photo-resistor where the resistance is depending upon the amount of visible light that hits the photo-resistor.

The flame amplifier is an electronic amplifier that amplifies the varying current through the photo-resistor, caused by changes in the flame brightness when the generator is running.

The flame amplifier is fitted with a potentiometer screw in the front for set point adjustment.

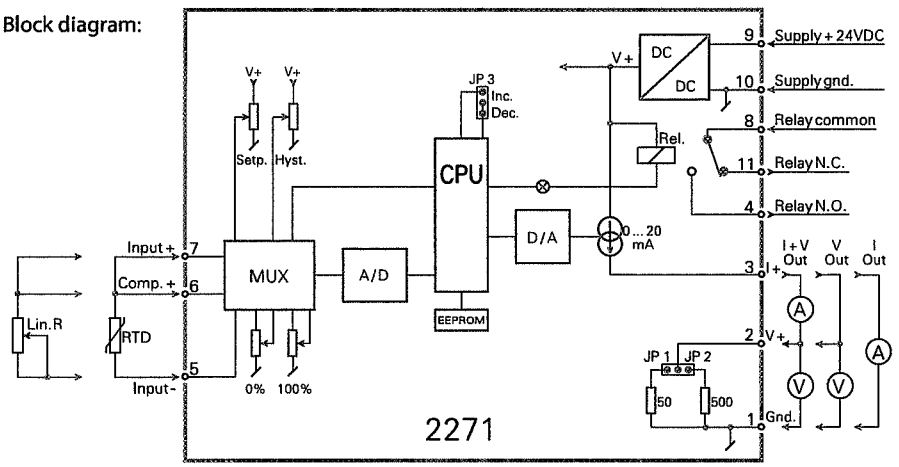
To adjust the sensitivity to a correct level, this procedure has to be followed:

1. Adjust the controller by turning the potmeter clockwise until the LED is lit.
2. From the point the LED is lit, turn the potmeter slowly counter clockwise turning off the LED (limit for max. operation sensitivity).

In case of trouble:

- a) Clean the glas inside the sight glases.
- b) Test the function using a flash light directly towards the flame scanner. The LED should be lit.

Block diagram:



For 2-wire connection, pin 6 and 7 must be short-curcuited in the socket

Hamworthy**KSE**

Part no: M0339-001

TG: Item: 202

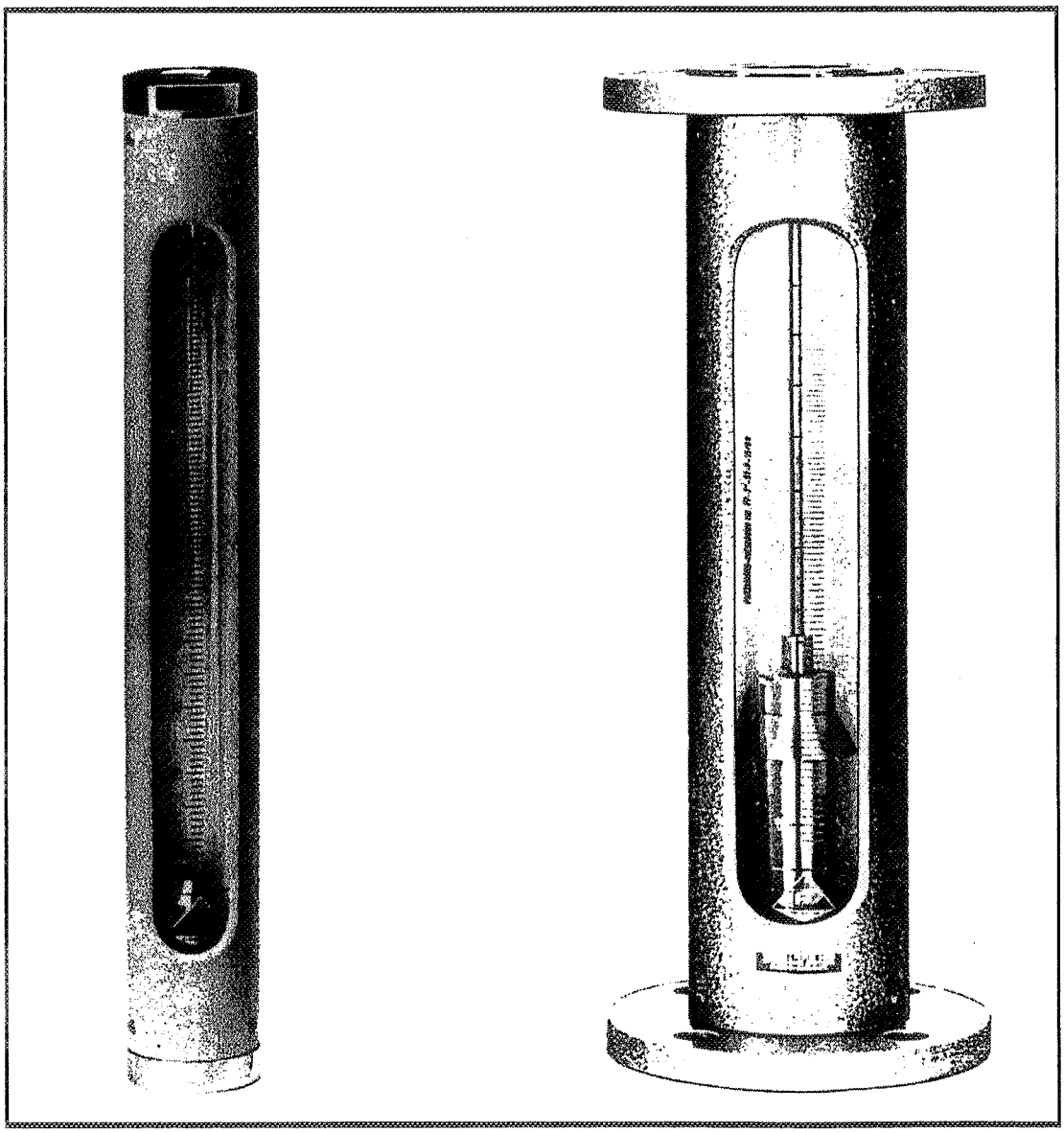
Rev: 00

Date: 20030317

FLOW INDICATOR

Mod. 10A1197ASS

Connect: 1/2" BSPI



1. Introduction

Fischer & Porter Series 10A1190 Variable Area Flowmeters operate on the variable area principle to meter fluid flow.

The elevation on the float in the tapered glass metering tube is proportional to the fluid flow rate. Readings are taken from the scale on the metering tube. The scales are graduated to provide one of four readings: diameter ratio (Dt/Df), percentage, millimeter or direct reading. When required a variable area flowmeter handbook or curves will accompany the meter.

2. General

All Series 10A1190 Flowmeters are available with either screwed or flanged end fittings for vertical piping. All meters are provided with "O"-rings of material specified at the time of purchase. Should requirements of the fluid being metered demand a change in materials, this may easily be accomplished in the field.

2.1 Important

It is imperative that the following precautionary measures be observed in order to minimize, and hopefully eliminate, the possibility of operator injury.

1) Glass meter tubes have been designed to operate up to maximum design working pressures listed herein. This not to be construed as a certification that the tubes will not break at any pressure. Inherent material limitations can result in tube breakage due to conditions beyond our control. For example: glass is a brittle material which may break upon impact; glass if subjected to thermal shock may break; glass is notch sensitive in that scratches, nicks or cracks may result in breakage when pressurized; incorrect installation or faulty operating methods can cause tube breakage regardless of operating pressure.

2) Glass meter tubes are not recommended for either hot or strong alkalies, flourine, hydroflouric acid, steam or water over 93 °C (200 °F). Glass meter tubes should be periodically inspected for signs of wear. Erosion, stress cracks, nicks or deep scratches provide early warning for tube replacement. With certain fluids, the glass may erode evenly so wear is not visibly noticeable. If wear is suspected, the tube should be replaced in order to eliminate this potential cause of meter tube breakage.

3) It is important that all materials of construction be compatible with the service to which the meter is applied. It is especially important that "O" ring material be compatible with the process fluid. Glass meter tube breakage can occur in those meters using an "O" ring as an internal seal if the improper material is used. For example:

Viton "O" rings must never be used for ammonia service; the corrosive attack of ammonia on Viton is extreme, causing the "O" ring to swell to the extent of breaking the glass meter tube. Refer to F&P for material selection.

4) The meter should never be subjected to excessive vibration. Avoid the use of quick acting devices in the fluid stream in order to prevent shock waves, associated with such devices, from damaging the meter.

5) The use of a pressure relief valve and/or a rupture disc is recommended in the pipeline containing the meter and located such to preclude glass meter tube breakage in the event of an overpressurization of the line.

6) When applied to a high pressure gas cylinder, at least two stepdown pressure regulators are to be used between the meter and the cylinder.

7) Remove pressure from the meter before attempting to remove the meter tube.

8) Be sure the parts that serve to lock the meter end fittings in place are secure. This should be checked before the meter is put into service or returned to service after maintenance. Loose end fittings may result in glass meter tube breakage.

9) The glass meter tube should be periodically inspected and replaced if cracked, nicked, scratched or worn.

10) Do not operate the meter without an operator protection shield in place. To do so may result in operator bodily injury.

3. Installation

3.1 General

In general, when a meter is to be used for gas service, it should be located as closely as possible to a throttling point but preferably with the valve located at the outlet fitting. Inlet piping size for gas service should be kept to a minimum. For liquid service however, piping should be as large as economically practicable.

Flowmeters must be installed vertically with the outlet (highest scale graduation) at the top. Use of a plumb bob or equivalent device to check vertical alignment is recommended. **Except with small meters, the float is usually packed separately and must be installed before the meter is placed in operation. Often the float is protected during shipment by a plastic coating or by a strip of tape around the metering edge. Remove the protective covering just before installing the float in the meter.** Refer to the Maintenance section for instruction on float installation.

3.2 Surge Chambers and Accumulators

Surge Chambers and Accumulators are frequently used on flow installations to smooth out pulsations of the metering float where reciprocating pumps or compressors are used on the feed lines to the meter. Surge chambers, when used on liquid service, may have a gas introduced on the upper side of the chamber.

When it is objectionable to have the gas in contact with the liquid, accumulators are used. Accumulators are similar to surge chambers except that they include a rubber bag on the upper side which seals the gas from the liquid. Accumulators usually have the rubber bag factory sealed with nitrogen or other suitable gas to a pressure of approximately 60 % of the pumping pressure. It is recommended that the manufacturer be consulted for the correct size surge chamber or accumulator required to suit the installation.

3.3 Pipe Mounting

Flowmeters of a smaller size will, in general, be adequately supported by the connecting piping. It is recommended that by-pass piping be placed around the meter to allow continuous flow through the pipe line while the meter is being serviced. Fig. 10A11.11 and 10A11.12 show typical installation piping of a flowmeter.

4. Placing the Meter in Operation

Gradually start flow through the meter by opening the flow rate valve. A gradual start-up reduces flow surges that may damage the float, outlet float stop or tube. All air or vapor must be vented from the meter and pipe line when metering a liquid. Meter readings must be taken from the scale at the graduation which coincides with the reading edge of the float. Fig. 10A11.13 illustrates the reading edges of the various types of float.

Should float bounce occur in meters being used in gas service, it may be the result of one of the following reasons: Low pressure operation, long range tube and float combinations, heavy floats, operation near tube zero (at very low diameter ratios), or large piping volumes.

If bounce occurs or initiates only at low diameter ratios and the lower portion of the scale is not normally used, the problem may be corrected in the size 1 1/2" meter by using an extra long inlet float stop. This will of course render the lower portion of the scale unusable.

Liquid pulsation is often caused by a pump with a pulsating discharge by pipe vibrations. If these conditions cannot be altered, a surge chamber is usually the best available solution. (Refer to paragraph 3.2). This chamber should be located as closely as possible to the pump or source of vibration.

5. Maintenance

5.1 Tube and Float Removal, Tube Cleaning and Float Installation

The float is a precision manufactured part; be careful not to nick, drop or damage it otherwise as this will adversely affect accuracy. Never subject the metering tube to unnecessary shock or strain. Care must be taken when removing the metering tube to note locations of float stops at both ends of the tube. When reassembling the meter, stops must be located at their original place. In order to remove the metering tube and float proceed as follows:

1. Disconnect the meter from the piping. Unscrew the Allan-screws of the upper fitting.
2. Grasp the metering tube and slowly but firmly pull the tube up and out of the housing. Make certain that the float does not drop out and becomes damaged when lifting the tube from the meter body.

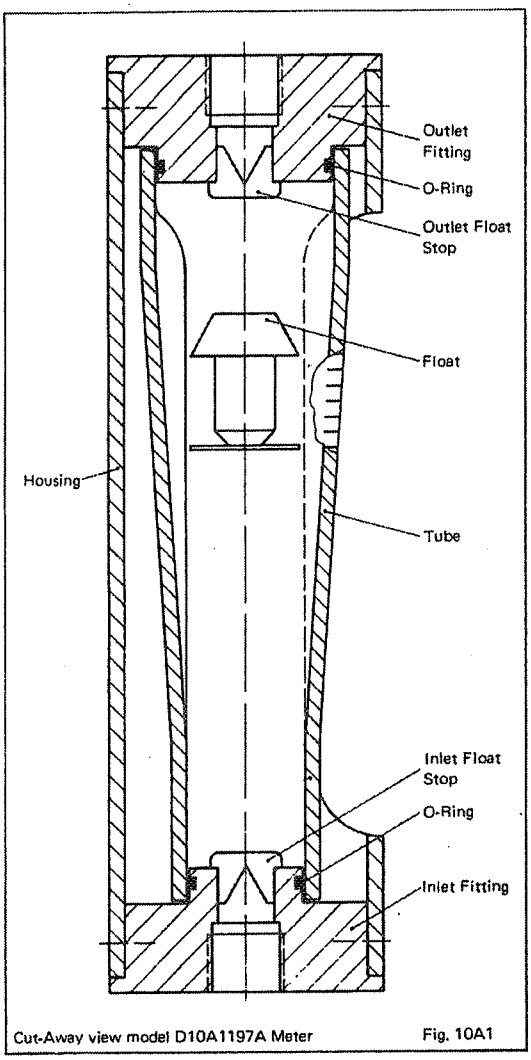
5.2 Assembly

Essentially, assembly of the meter is reverse of disassembly shown above. When assembling "O"-rings on fittings it is advisable to lubricate the "O"-rings with silicone grease.

Care should be exercised in replacing the tube and float so that the lowest scale reading is at the bottom of the meter and the float is properly oriented. (Refer to Fig. 10A11.13). Note also that float stops are positioned as they were before disassembly.

6. Spare parts order

When ordering eventually necessary spare parts, please, always indicate the number of the instrument. You will find this instrument number on the name-plate at the housing of the flowmeter.



Cut-Away view model D10A1197A Meter Fig. 10A1

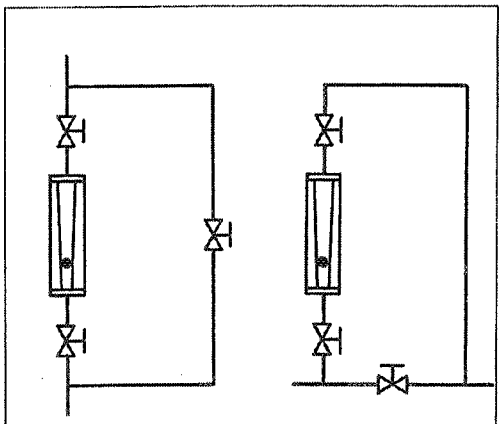


Fig. 10A11.11 Typical vertical line installation

Fig. 10A11.12 Typical horizontal line installation

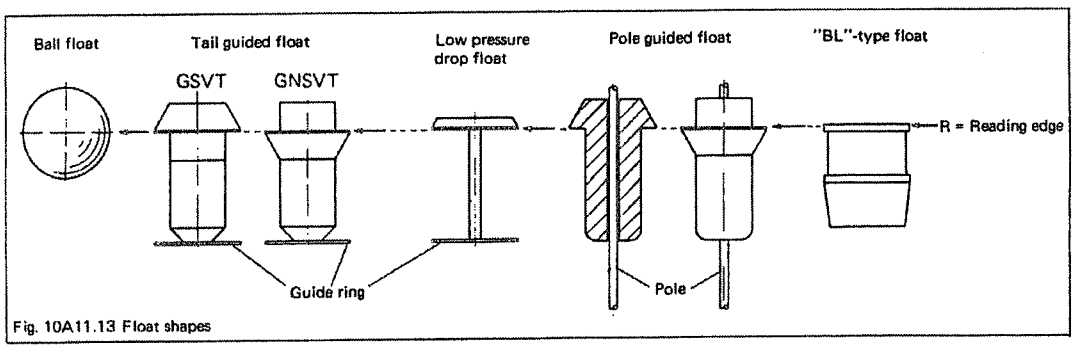
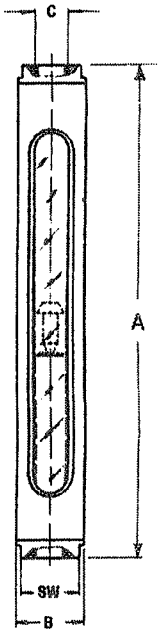


Fig. 10A11.13 Float shapes

The instructions given herein cover generally the description, installation, operation and maintenance of subject equipment. Should any questions arise which may not be answered specifically by these instructions they should be directed to Fischer & Porter for further detailed information and technical assistance.

Part no: M0339-001 Item:

Dimensions



Mod. 10A1197A(P)

Meter size	Screwed connection C	A	ϕB	Wrench flat size
1/16" / 1/8" / 1/4"	R 1/4"	260	24	SW 19
1/2"	R 1/2"	405	38	SW 32
3/4"	R 3/4"	405	51	SW 46
1"	R 1"	405	57	SW 50
1 1/2"	R 1 1/2"	420	76	SW 65
2"	R 2"	420	95	SW 85
3"	R 3"	550	133	–
4"	R 4"	550	159	–

Hamworthy Moss AS

Part no: M0124-001

FG: Item: 175, 179

Rev: 01

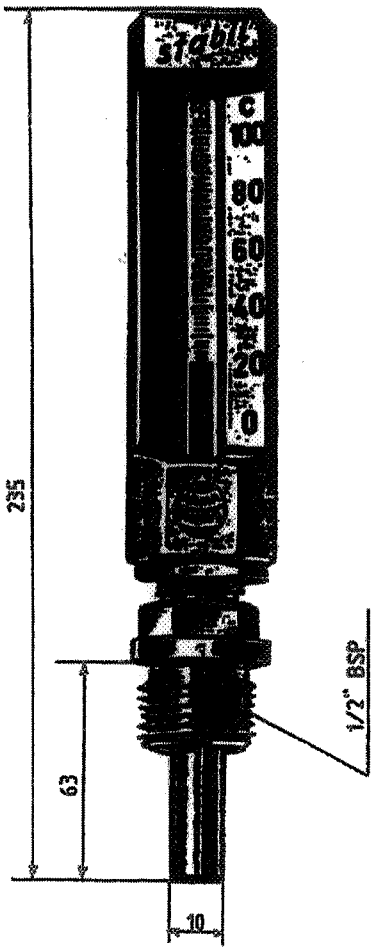
FG: 175, 178, 179

Date: 20050527

THERMOMETER

Range: 0-100°C

Connect: 1/2" BSP



11-206

Hamworthy Moss AS

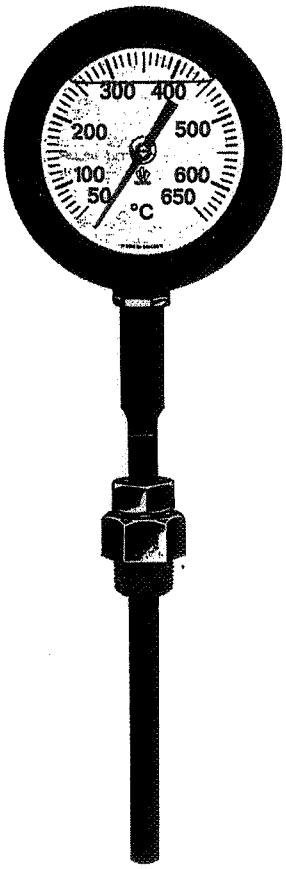
Part no: M0126-001 FG% Item: 176,

Rev: 00 Date: 20050706

HOT GAS THERMOMETER

SPECIAL THERMOMETERS FOR DIESEL ENGINES

3/4" BSP



Technical specification

- These dial thermometers were designed for especially rough applications and have been well-tried under extreme shock and vibration conditions in all combustion engines and exhaust pipes in ship-yards, in engine construction and in industry.
- Heavy-duty design.
- The liquid filling in the case stabilizes the measuring system and all interacting parts against strong shock and vibrations. They are corrosion- and wear resistant being especially developed for these types of operating conditons.

Type H 14 Ø120 mm - radial connection

- Cast iron case Ø 120 mm, especially sturdy.
- Water, dust and oil- proof.
- With 3-piece clamped-threaded steel connection for adjustable mounting length.
- Quick- responding.
- Accuracy class +/- 1% of final scale value.
- With "Sekurit" safety glass dial cover.
- Protection class IP 54
- Temperature range: +50...+650°C
- 3/4" BSP connection
- Mounting length: L_1 = 300 mm

11 - 207

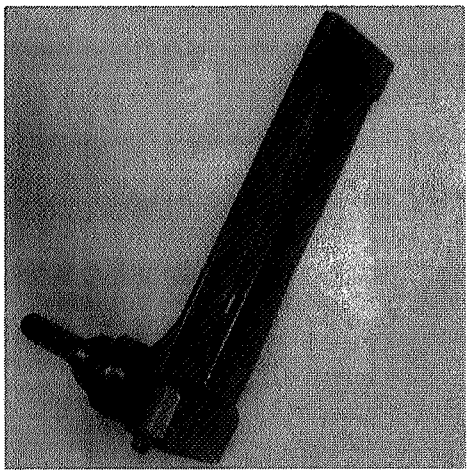
Hamworthy Moss AS

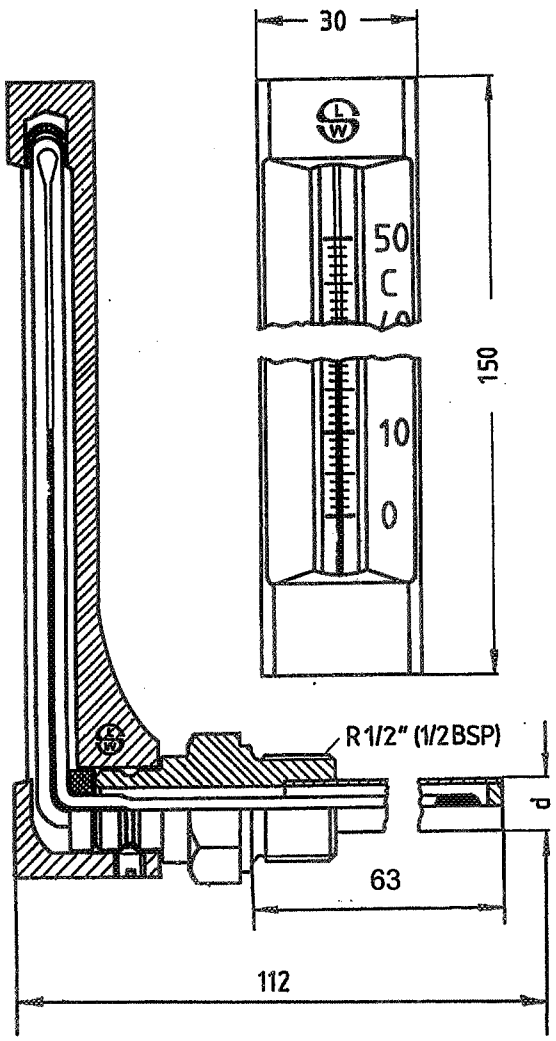
Part no: M0125-001 FG: Item: 177, 178

Rev: 00 Date: 20071127

THERMOMETER 0-100 °C

90° type, L=63mm





11-208

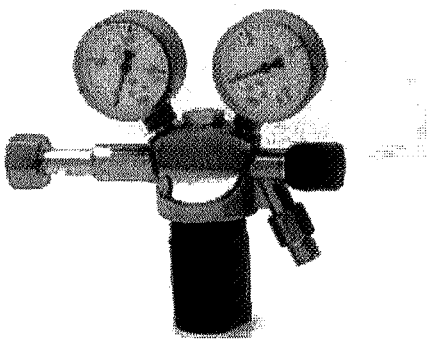
Hamworthy Moss AS

Part no: M0234-002 Item: 206

Rev: 00 Date: 20080218

PRESSURE REGULATING VALVE

With manometer



Constant cylinder pressure regulators fulfil the specifications of DIN 8546 (1976 edition) and ISO 2503. The DIN 8546 specifiction is similarly adhered to for special designs.

These pressure regulators are designed for connection to gas cylinders used for compressed gases, gases dissolved under pressure and liquefied gases.

IMPORTANT!
Please observe the regulations and rules valed in your country.

Supply range (summary)

Type of gas	Working pressure (bar) [1] single-stage pressure regulators							Regulators with >Z< type regulating unit [2]	
	up to 1.5	up to 2.5	up to 4	up to 10	up to 20	up to 50	up to 100	up to 2.5	up to 10
Acetylane	X								
Ammonia		X							
Compressed air		X		X	X	X	X	X	X
Carbon monoxide				X					
Carbon dioxide, rare gas				X	X	X	X	X	X
Gas mixtures (Mapp etc.)	X	X							
Propane		X							
Testing gases				X				X	
Oxygen				X	X	X	X	X	X
Sulphur dioxide		X							
Nitrogen				X	X	X	X	X	X
Hydrogen, methane, forming gas, town gas				X	X	X	X	X	X

[1] The pressures stated are gauge pressures

[2] Method of operation similar to two-stage cylinder pressure regulators

Part no: M0234-002 Item:

1. **Start**

1.1. **Connecting the pressure regulator**

Make sure that the pressure regulator is suitable for the type of gas to be used (See para 4 on designation)

Before screwing on the pressure regulator, breifly open the cylinder valve 1 and close again in order to blow out any dirt.

Connect up the pressure regulator with the union nut or stirrup 2 to form a gas-tight seal with the cylinder valve 1. The spring cap with the adjusting screw 5 must point vertically downwards. Fit the hose to the hose connection 7 and the gas consumption unit, using suitable hose clips to secure it.

Shutoff valve Pos. 6 has a stuffing-box package. In case of leakage, tighten up stuffing-box nut Pos. 9.

IMPORTANT:
Use only tools that are in good order.

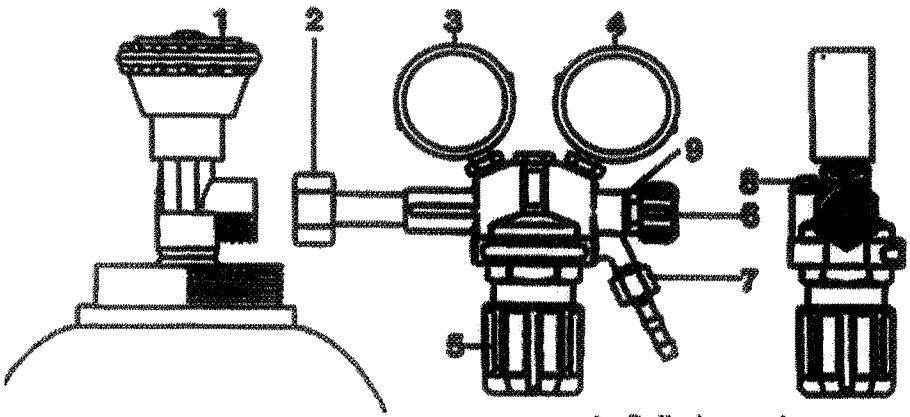
1.2. **Setting the pressure**

First, close the shut-off valve 6 and relieve the regulator from pressure by unscrewing the adjusting screw 5. Open the cylinder valve gradually. The inlet pressure gauge 3 shows the cylinder pressure.

Open the shut-off valve 6 and slightly open the shut-off valve arranged on the gas consumption unit. Now screw the adjusting screw 5 back in again until the desired outlet pressure is set which can be read off on the outlet pressure gauge 4. Where there are great variations in the volume of gas consumed, it is possible that a slight deviation may occur from the preset outlet pressure. In this event, the outlet pressure must be re-adjusted by means of the adjusting screw 5.

2. **Taking out of service**

In the event of short breaks between operations it is sufficient to close the shut-off valve 6. In the case of lingish intervals between operations or when work is finished, close the cylinder valve 1 and the shut-off valve 6, and relieve the regulator from pressure by unscrewing the adjusting screw 5.



1 Cylinder regulator
2 Pressure regulator connection
3 Inlet pressure gauge as per ISO 5171
4 Outlet pressure gauge as per ISO 5171
5 Adjusting screw
6 Shut-off valve
7 Hose connection as per ISO 3253
8 Blow-off valve
9 Stuffing-box nut

Part no: M0234-002 Item:

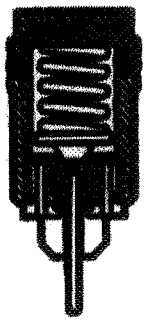
3. Operating and maintenance instruction

3.1. General remarks

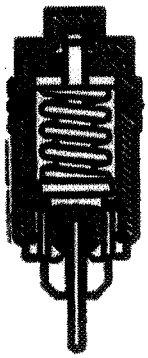
Keep all components that come into contact with oxygen free from oil and grease on accout of explosion risks!

3.2. Regulating unit

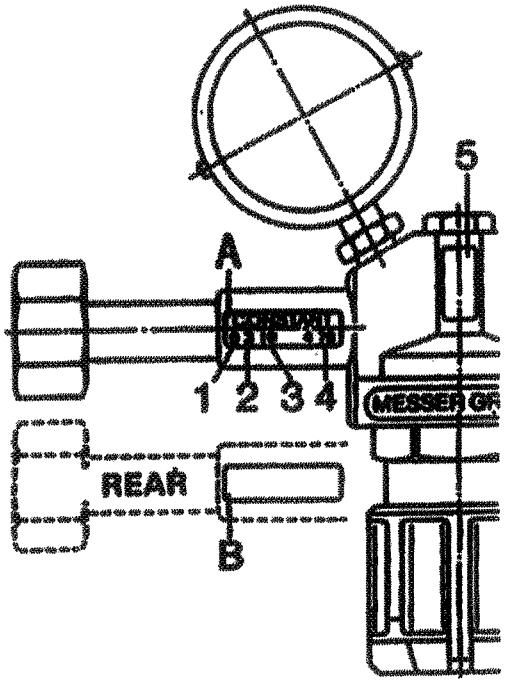
The regulating units are exchangeable. Make sue that the O-rings are in perfect order and that the sealing faces are undamaged.



Regulating unit without inlet pressure compensation



Regulating unit >Z< with inlet pressure compensation



3.3. Safety valve

Do not alter the setting of the safety valve. Faulty units may only be repaired in an authorized repair workshop.

3.4. Spare parts

Only genuine Hamworthy spare parts may be used for maintenance and repairs.

4. Designation

A Designation of type (on front)

1 Type of gas

2 Classification of unit as per ISO 2503

3 Maximum operating pressure

4 Serial number

5 Color code for type of gas as per standards of the country concerned.

B Official designation (on rear) or article-no.

Hamworthy Moss AS

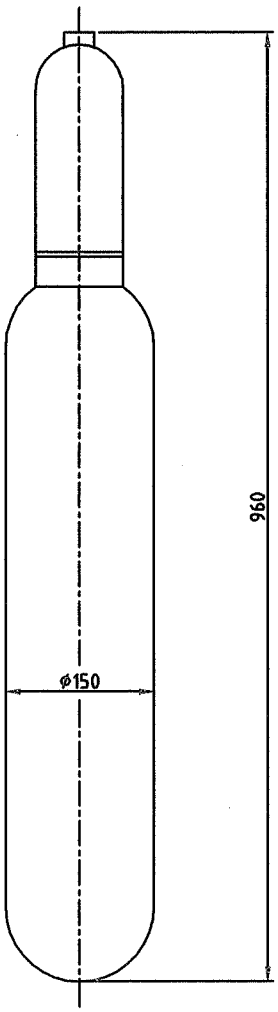
Part no: M0233-002 Item: 207

Rev: 01 Date: 20050601

N_2-BOTTLE

Span gas bottle nitrogen

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.



MATERIAL:
SEAMLESS STEEL WITH
CHROMIUM AND MOLYBDENUM

WEIGHT EMPTY: 18 Kg

Bygg nr. Yard No	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced	Kontr. Checked	Godkj. App'd.	Date Date	Skala Scale	Gruppe nr. Group. No.
MOSS STANDARD			MLF			20020226	1:5	6400

Proj.metode Proj.method

MOSS INERT GAS SYSTEM

Erstn. for Replacec | Erstattet av Replaced by

Hamworthy KSE a.s, Moss
Liquid Cargo Handling

Title: N2-BOTTLE 10l
ITEM 207
ARRANGEMENT

M2144-002std Rev. 00

Side Sheet 1 av of 1 sider sheets Format A4

Forandringer: REV 00) 20020226/

11-212

Hamworthy Moss AS

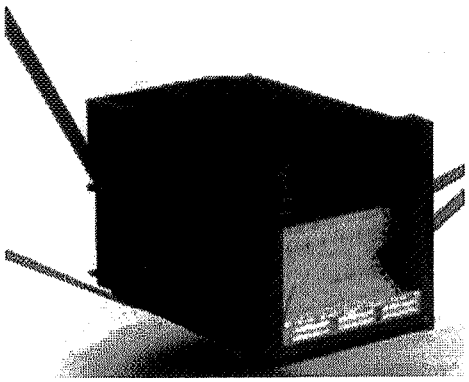
Part no: M5148-002txt FGi Item: 217

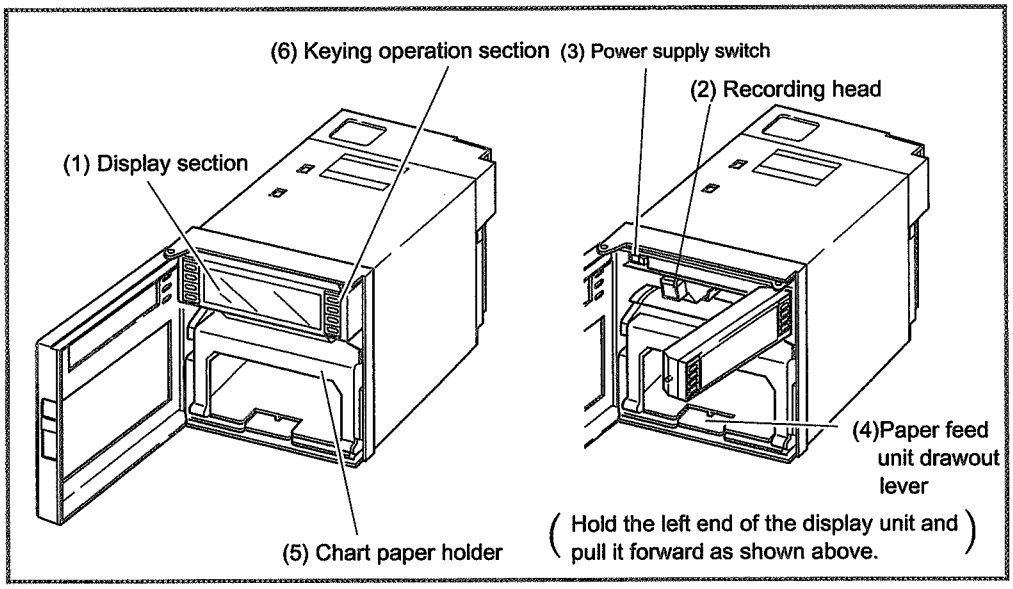
Rev: 02 Date: 20050608

MICROJET RECORDER

Type: PHC

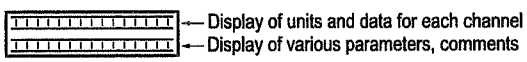
Instruction manual





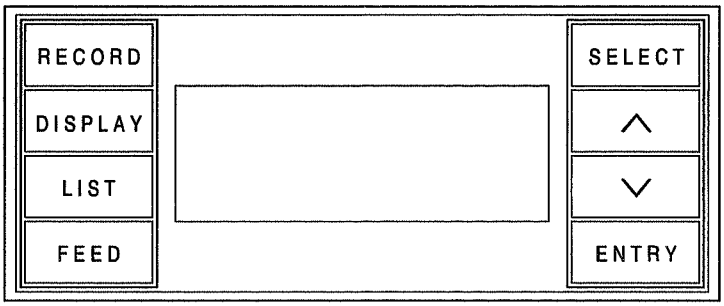
Names and functions of parts

1. Display section
   For displays such as measurement data and displays of various parameters and comments



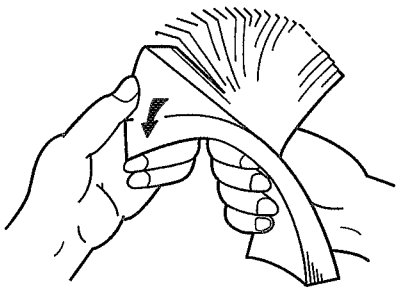
2. Recording head
   This is a recording head which serves for analog trend recording and digital print-outs. As this is not installed in the main unit at the time of delivery, please install it referring to Section 5.2.
3. Power supply switch
   Used to turn the power on and off.
4. Paper feed unit drawout lever
   When setting (or replacing) chart paper, push down the drawout lever. The paper feed unit willcome out. If it does not come out, pull it forward while holding the lever down.
5. Chart paper holder
   The chart paper holder is used to feed paper smoothly.

6. Keying operation section
   This is used for setting various parameters, making checks and running the equipment.



Name of key	Function
RECORD	Operation key for starting and stopping recording. Recording starts when the key is pressed once and stops when the key is pressed. This key is ineffective during print-out of data or lists.
LIST	This is used for effecting print-out of data (instantaneous values). If you wish to stop the print-out partway through, press the key again. This key is alwys effective.
FEED	Chart paper fast-feed key. Feed speed is 3mm/s at the beginning of press, and about 8mm/s after 1 second. This key is always effective.
DISPLAY	1. Used for changing the data display. The following 5 items are selected at each press. (1) Data of all channels are displayed in order, except for the skip channel. Data display is updated at intervals of l second and channels are selected every 3 seconds. (2) Display only of the data of specific channels. The data display is updated once every second. (3) No. 1 to 6 channels are displayed simultaneously, and data display is updated at 1 second intervals. (4) Display of the date and time. 2. This key is used for shifting from a set mode to the data display mode. This key is ineffective during print-out of data or lists.
SELECT	1. Used for shifting from the data display mode to a set mode. 2. Is used for effecting sequential read-out of parameters during operation in a set mode. This key is ineffective during print-out of data or lists.
ENTRY	Is used to register set data. This key is effective only during set mode operation.
∧ ∨ (up) (down)	Used to scroll numerical values up and down. The values are scrolled up or down 1 count each time the relevant key is pressed. Holding a key depressed for more than 0.5 seconds results in a fast up/down scroll at a rate of 5 counts/second and holding it depressed for a further 2 seconds results in an ultra-fast scroll of 55 counts/second.

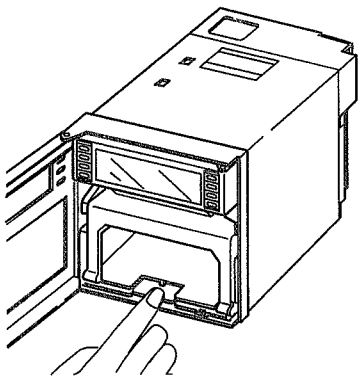
Set up - Loading Chart Paper



Step 1

Prepare chart paper.

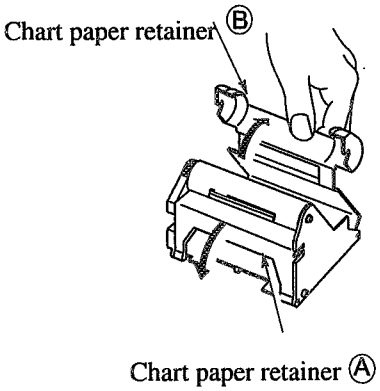
Loosen chart paper to prevent some sheets of paper from being fed together.



Step 2

Open the front door and press down the paper feed unit drawout lever.

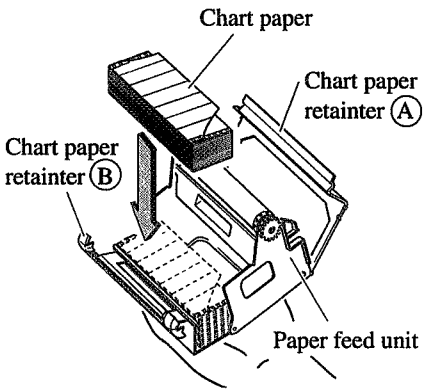
The paper feed unit will be drawn out.



Step 3

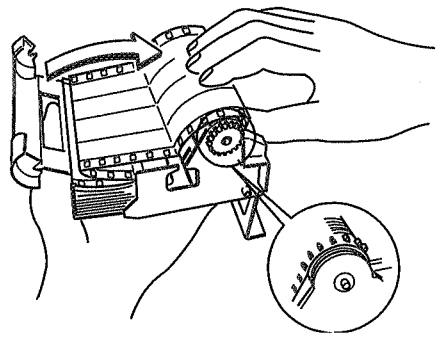
Hold the chart paper retainer B and open it backward.

Also, hold and open the chart paper retainer A .



Step 4

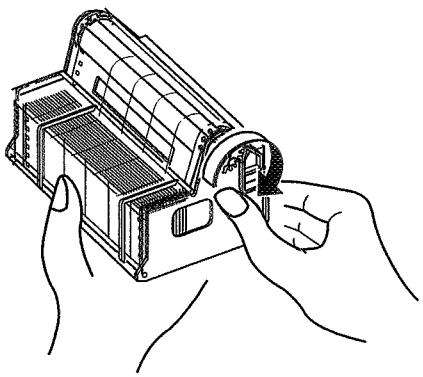
Set chart paper in the chart paper retainer B as illustrate



Step 5

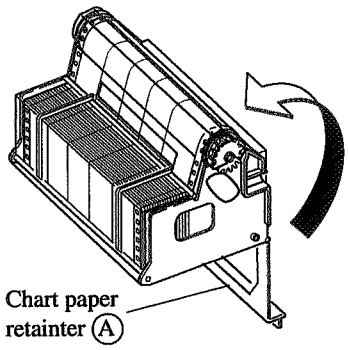
Insert the sprocket correctly in the perforations of chart paper. Move down the chart paper retainer B and set the paper on the roller unit. At this time, make sure that both ends of the chart paper retainer A are locked securely.

Note: If some sheets of chart paper are folded and caught between the chart paper retainer B and the roller unit, set the paper once again.



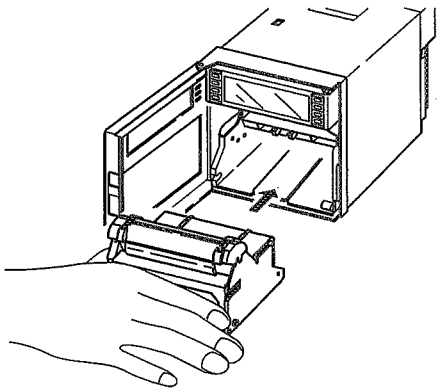
Step 6

Shift the chart paper forward by turning clock-wise the gear of the roller unit with hand.



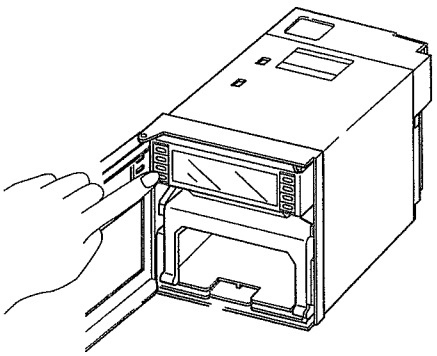
Step 7

Transfer the chart paper which has been shifted forward, into the storage of the paper feed unit. Then set the chart paper retainer A .



Step 8

Mount the paper feed unit in the recorder. At this-time, check that it is properly locked in position.



Step 9

Press the FEED key and check that the chart paper is fed out smoothly. (Feed out about 2 folds of paper.)

If the paper is not fed out smoothly, go through the procedure from Step 2 again.

Note 1: Selection of chart paper

The chart paper greatly affects the quality of the printed recording and it is also related to problems such as paper jamming, etc. Please be sure to use the pure-quality chart paper specified us. Chart paper type : PEX00DL1-5000B (50 equal divisions, no time lines)

Note 2: Use of recorder after it has been left unused for a long time

If the recorder is left unused for a long time with chart paper still in the main unit, the paper 'packs down' and if the recorder is used straightway there can be problems of paper jamming, etc. If you use the equipment after it has been left unused for a long time, first press the FEED key to feed out 2 to 3 folds of the paper.

Reference 1: Chart paper lenght

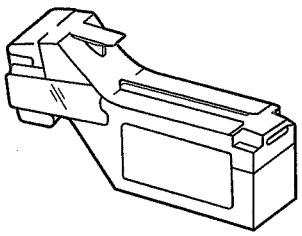
The chart paper is approximately 15m long. This permits about 31 days continuous print-out at a paper feed speed of 20mm/h.

Reference 2: Chart paper end mark

The amount of chart paper remaining is indicated by digits (units : 10cm) on the right-hand side of the paper. When there is only a small amount left, red letters appear on the right-hand edge. If the recording paper runs out completely, a recording paper end indicator displays 'Chart end' in the display section and recording autmatically stops

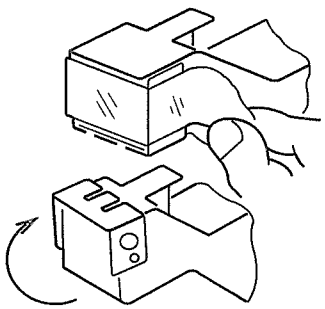
Recording head installation (replacement)

The recording head is a combination of a head and ink. When ink is used out or trouble arises with the head, it can easily be replaced. Use the recording head carefully observing the "Caution" noted in the later paragraph.



Step 1

Get the recording head ready by taking it out of its aluminium pack.

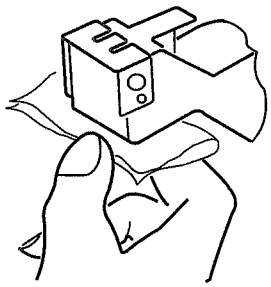


Step 2

Tear the tape. Open the cap by turning it in the direction indicated by the arrow.

(If the head is not going to be used for a long time, close the cap back in its original position.)

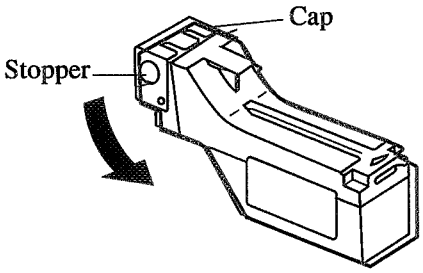
The cap is integral with the head unit. Turn it about 180° until it stops against the top of the head.



Step 3

Lightly press the nozzle surface (the surface from which ink is discharge). Make sure that the cloth is properly impregnated with the 4 colors blue, red, yellow and black. (First press the cloth against the surface for 2 to 3 second; if the 4 colors ooze out, it is OK.)

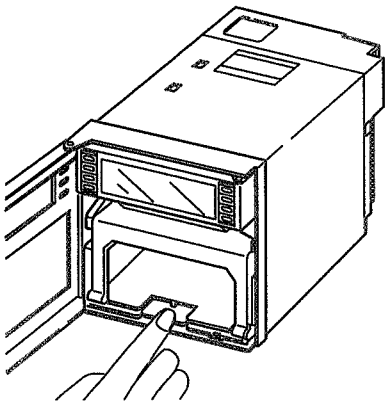
Note: Do not use any cloth other than the supplied one. Also, do not rub the nozzle with the cloth.



How to close the cap:

Turn the cap in the direction indicated by the arrow and press it firmly until it is retained by the stopper.

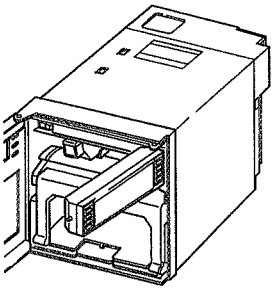
Ink may leak out if the cap is not properly in place.



Step 4

Press the RECORD key. Operate the recorder after it has been set in recording stop mode.

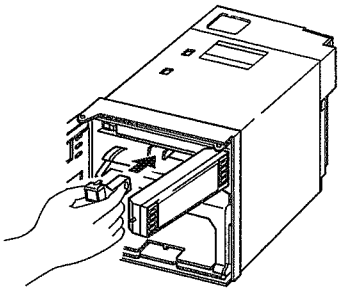
Open the front door and press down the paper feed unit drawout lever. The paper feed unit will be drawn out.



Step 5

Hold the left end of the indicator and pull it forward.

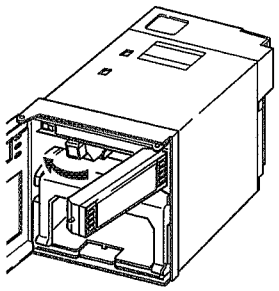
The indicator will turn 90°.



Step 6

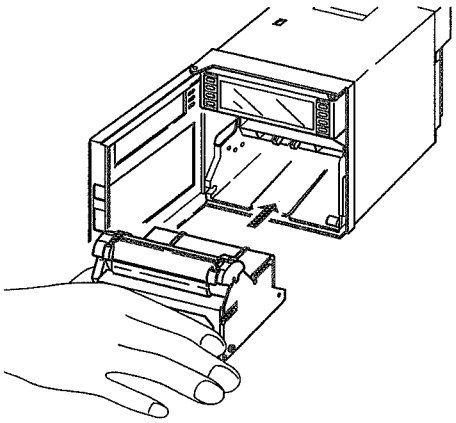
Hold the recording head horizontal, line it up with the carriage in the main unit slide it in slowly and press it firmly until it does not go in any further. Take care not to bang the nozzle surface of the head. Also, avoid touching the nozzle surface with your hand.

CAUTION: Do not touch the connector at the rear of the carriage to avoid the risk of minor electric shocks.



Step 7

Set the indicator in its original position.



Step 8

Set the paper feed unit in its original position.

The above completes installation of the recording head.

The recording head is a consumable part. Replace it with a new one when the ink it contains is used up.

Recording head replacement

Draw out the recording head in the manner that is opposite to what is described in Step 6 of the recording head setting procedure, and replace it with a new recording head

Hamworthy Moss AS

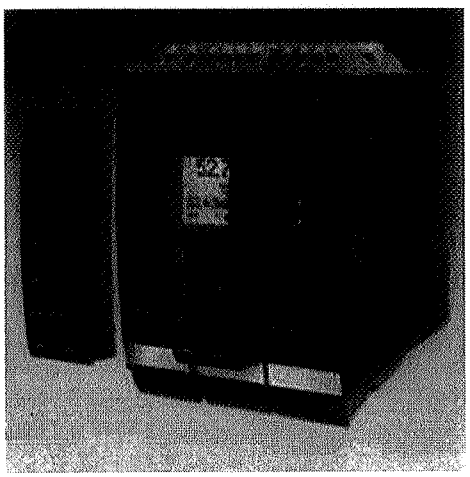
Part no: M2100-002 FG & Item: 200, 204

Rev: 00

Date: 20071105

UNIVERSAL TRANSMITTER

TYPE 4116 + 4501



- Input for RTD, TC, Ohm, potentiometer, mA and V
- 2-wire supply > 16 V
- FM-approved for installation in Div. 2
- Output for current, voltage and 2 relays
- Universal AC or DC supply

Advanced features

Programmable via detachable display front (4501), process calibration, signal and relay simulation, password protection, error diagnostics and selection of help text in several languages.

Application

- Linearised, electronic temperature measurement with RTD or TC sensor.
- Conversion of linear resistance variation to a standard analogue current / voltage signal, i.e. from solenoids and butterfly valves or linear movements with attached potentiometer.
- Power supply and signal isolator for 2-wire transmitters.
- Process control with 2 pairs of potential-free relay contacts and analogue output.
- Galvanic separation of analogue signals and measurement of floating signals.
- The 4116 is designed according to strict safety requirements and is thus suitable for application in SIL 2 installations.

Technical characteristics:

- When 4116 is used in combination with the 4501 display / programming front, all operational parameters can be modified to suit any application. As the 4116 is designed with electronic hardware switches, it is not necessary to open the module for setting of DIP switches.
- A green / red front LED indicates normal operation and malfunction. A yellow LED is ON for each active output relay.
- Continuous check of vital stored data for safety reasons.
- 4-port 2.3 kVAC galvanic isolation.

Order codes:

4116 = Universal transmitter
4501 = Display / programming front

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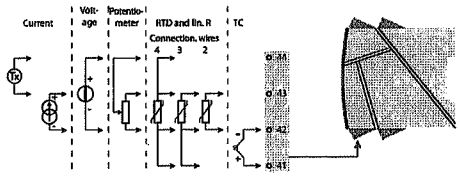
Hamworthy Moss AS

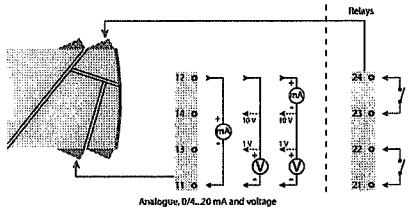
Part no: M2100-002 Item:

Applications

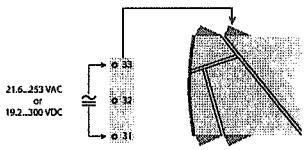
Input signals:



Output signals:



Supply:



PR 4501 Display / programming front

Application:

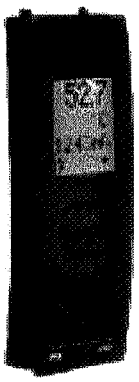
- Communications interface for modification of operational parameters in 4116.
- Can be moved from one 4116 module to another and download the configuration of the first transmitter to subsequent transmitters.
- Fixed display for visualisation of process data and status.

Technical characteristics:

- LCD display with 4 lines; Line 1 (H=5.57 mm) shows input signal, line 2 (H=3.33 mm) shows units, line 3 (H=3.33mm) shows analogue outputor TAG no. and line 4 shows communication and relay status.
- Programming access can be blocked by assigning a password. The password is saved in the transmitter in order to ensure a high degree of protection against unauthorised modifications to the configuration.

Mounting/installation:

Click 4501 onto the front of 4116



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Hamworthy Moss AS

Part no: M0111-001 FG: Item: 182

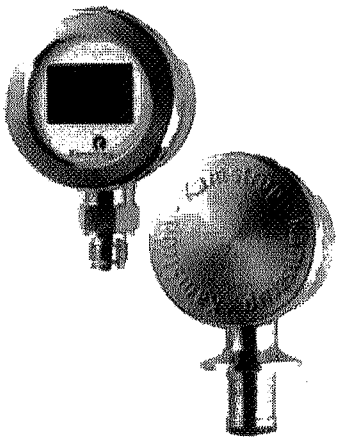
Rev: 02

Date: 20050527

FlexBar HRT -0,05..0,25bar

Pressure Transmitter

Type 81-612-121-1111



Product information

FlexBar HRT Type 81-612-121-1111	
Input	-0.05....0.25 bar
Output	4...20 mA
Safety	Demko EEx ia IIC T5/T6, ATEX II 1G
Cabel connection	Gland PG13.5
Process connection position	At the rear
Diaphragm surface	Standard
Oil filling	Ondina (Recommended for food industry applications)
Process connection standard	Flush diaphragm, male nipple G1/2A PN400 AISI 316L
Pressure type	Relative pressure (bar)

Mechanical data

Material

- Housing: Stainless steel (AISI 304/W1.4301)
- Pressure sensor: Polysilicon strain gauge
- Fill fluid: Ondina, Halocarbon or DC550
- Wetted parts: Acid - proof stainless steel (AISI 316L/W1.4404) or Hastelloy C
  PTFE - teflon coating.

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Hamworthy Moss AS

Part no: M0112-001 TG: Item: 220

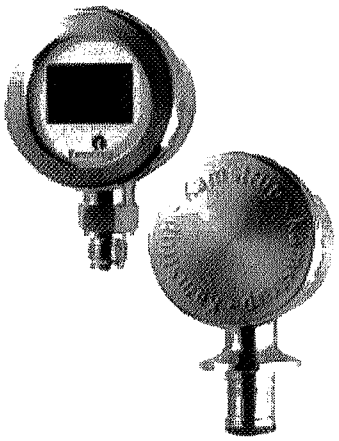
Rev: 01

Date: 20050527

FlexBar HRT

Pressure Transmitter 0-0.3bar

Type 81-611-121-1111



Product information

FlexBar HRT Type 81-611-121-1111	
Input	0.0...0.3 bar
Otput	4...20 mA
Safety	Standard version
Cabel connection	Gland PG13.5
Process connection position	At the rear
Diaphragm surface	Standard
Oil filling	Ondina (Recommended for food industry applications)
Process connection standard	Flush diaphragm, male nipple G1/2A PN400 AISI 316L
Pressure type	Relative pressure (bar)

Mechanical data

Material

- Housing: Stainless steel (AISI 304/W1.4301)
- Pressure sensor: Polysilicon strain gauge
- Fill fluid: Ondina, Halocarbon or DC550
- Wetted parts: Acid - proof stainless steel (AISI 316L/W1.4404) or Hastelloy C
  PTFE - teflon coating.

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Hamworthy Moss AS

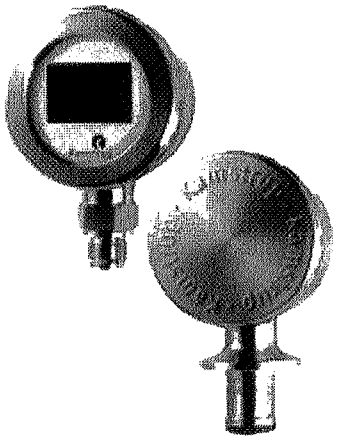
Part no: M5724-001txt Item:

Rev: 01 Date: 20050608

FlexBar HRT

Pressure Transmitter

User manual



4...20 mA, 2-wire transmitter, HART ® communication

Configurable span, unit and damping

Turn down 25:1

Zero point adjustment

2-point calibration

-1(0)...400 bar

Gauge or absolute pressure

400% overpressure safety limit

Hygienic process connections

Demko EEx ia IIC T5/T6, ATEX II 1G

Demko Ex N IIC T5/T6

Barbara Ex ia IIC T5/T6

Description

FlexBar HRT is a loop powered, configurable pressure transmitter. FlexBar HRT measures the pressure by means of a polysilicon strain gauge-sensor. The electronics are separated from the media by a thin diaphragm and an oil-filling. Three different oil fillings are available including a mineral oil complying with demands from FDA for use in the food and pharmaceutical industries.

The electronics are located in a separate sealed housing giving FlexBar HRT superb resistance to moisture. Cable connection is via gland or plug.

The HART ® communication features on-line process calibration/adjustment and transmitter configuration.

FlexBar HRT is used in food, chemical and petrochemical industries to measure absolute or gauge pressure for machine and hydraulic applications etc.

The wide range of process connections together with the configurable facilities make FlexBar HRT the ideal choice for all pressure measuring applications.

Hygienic process connections for a wide range of standards are available for FlexBar HRT with a flush diaphragm and G1/2A male nipple. Please refer to the data sheet for FlexBar HRT Accessories .

The FlexView LC-display is optional.

Additional Description

The mounting of the pressure sensor ensures fast response time, excellent temperature compensation and high measuring accuracy. All diaphragm weldings are checked with a helium leak-tester.

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Hamworthy Moss AS

Part no: M5724-001txt Item:

Technical Data

Input	
Measuring limits	See datasheet "M0111-001"
Overpressure	400% of f.r., max. 600bar
	(continuously
Output	
Signal span	4...20 mA or 20...4 mA {1}
	2-wire, HART ® communication
Output limits	3.5...23 mA {1}
Characteristic	Linear or customised with
	max. 30 points {1}
Accuracy	< 0.2% f.r.
Isolation voltage	500 V_{ac}
(From housing to 4...20 mA connection)	
Resolution	12 bit
Load equation	RL <= (VCC -6.5)/23 [kOhm]
Display (optional	
Please refer to FlexView data sheet	
Opto-relay	
Voltage, standard	Max. 230 V_{ac}
Voltage, GL-approved	Max. 60 V_{ac}
DC-voltage	Max. 50 V_{dc}
Current, continuously	Max. 50 mA
Current, pulse	Max. 500 mA
Relay function	Set/reset {1}
Configuring limits	
Span	4...100% of full range {1}
Zero point	0...96% of full range {1}
Auto zero	-10...10% of full range {1}
Communication	
FlexProgrammer	PC-program (Windows) 2-way
	communication (Refer to data
	sheet)
HART ® protocol	HCF standard
Features {1}	Read serial number
	Read/Change user ID
	Read/Change configuration
	Read input signal value
	Read output signal value
	Input signal logging
	2-point sensor trim
	Current output trim
Error handling	
Up/Down scaling	23 mA/3.5 mA {1}

Power Supply	
Nominal	24 V_{dc}
Supply voltage	6.5...35 V_{dc}
Effects caused by changes in power supply:	
Zero point	0.005% per V
Measuring range	0.001% per V
Operational conditions	
Storage temperature	-40...85°C
Process temperature	Standard: -30...120°C
	Cleaning <= 135°C for 15 min.
	Cooling neck: -30...200°C
Ambient temperature	-10...70°C
Relative humidity	< 98%, condensing
Protection class	Plug: IP 65
	Gland: IP 65 + IP 66
Vibrations	Lloyds Register, test 2
Shock test	100g for 10 msec.
Operational condition effects	
Ambient temperature influence, measured at -10...70°C	
and max. span:	
Zero point:	< 0.05% per 10K
Span:	< 0.05% per 10K
Process temperature:	< 0.2% per 10K
Cooling neck only: Media temperature (t_m) influence in the	
temperature interval 100...200°C:	
G1/2A:	20 mbar + (t_m - 100) x 2.0 mbar
DS 722:	20 mbar + (t_m - 100) x 0.5 mbar
ISO 2852:	20 mbar + (t_m - 100) x 0.5 mbar
3A/DN38:	20 mbar + (t_m - 100) x 1.0 mbar
3A/DN76:	20 mbar + (t_m - 100) x 0.5 mbar
Varivent:	20 mbar + (t_m - 100) x 0.5 mbar
Transitional behaviour	
Switch-on time	4 sec.
Sample time	0.5 sec.
Step response time	< 1 sec.
Damping, t_{99}	0...60 sec. (2 sec. steps) {1}
Long-term drift	Typ. 0.1% per year
EMC data	
Immunity	EN 50082-2
Emission	EN 50081-2

Hamworthy Moss AS

Part no: M5724-001txt Item:

Technical Data

Approval (Demko) EEx ia IIC T5/T6, ATEX II 1G	
Approval (Barbara) Ex ia IIC T5/T6	
Supply range	6.5...30 V_{dc}
Internal inductivity	L_i <= 10µH
Internal capacity	C_i <= 1 nF
Barrier data	U<=30V dc; <=0.1A; P<=0.75W
Temperature class	T1...T5: -10 < T_{amb} < 70°C
	T1...T6: -10 < T_{amb} < 50°C
Approval (Demko) Ex N IIC T5/T6	
Temperature class	T1...T5: -10 < T_{amb} < 70°C
	T1...T6: -10 < T_{amb} < 50°C

Disposal of product and packing

According to national laws or by returning to Bourdon-Haenni

Note

{1} Configurable

Materials	
Housing:	Stainless steel
	(AISI 304/W1.4301)
Pressure sensor:	Polysilicon strain gauge
Fill fluid	Ondina, Halocarbon or DC550
Wetted parts:	Acid-proof stainless steel
	(AISI 316L/W1.4404)
	or Hastelloy C
	PTFE-teflon coating
Electrical connection	
Cable entry	Gland PG9, PG13.5 or M20
	Plug DIN 43650, form B
Approval	
Germanischer Lloyd	(with cable type no. 81 26-940)

FlexBar HRT can be configured either with a handheld HART ® communicator or with the dedicated Bourdon-Haenni FlexProgrammer unit connected to a standard PC.

Unless specified FlexBar HRT is supplied with a standard configuration:

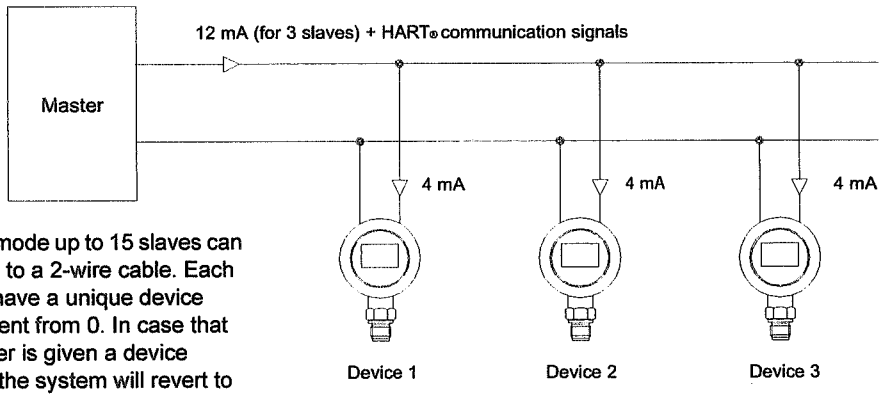
Pressure at 4 mA	: Minimum measuring limit
Pressure at 20 mA	: Maximum measuring limit
Damping	: 0 sec.
Device address	: 0

Accessories for FlexBar HRT are usually supplied separately and must be assembled by the customer. However, if you prefer the accessories to be assembled from the factory prior to delivery, please order type number 81 26-950.

Having the HART ® communication facilities the FlexBar HRT can be operated as a conventional 4...20 mA device, or it can be connected to other HART ® devices in a 2-wire HART ® network, in one of three connection methods:

Mixed-signal	: Please refer to HART ® literature
Point-to-point	: See „Applications“
Multi-drop	: See below

Multi-drop mode:



In Multi-drop mode up to 15 slaves can be connected to a 2-wire cable. Each device must have a unique device number different from 0. In case that one transmitter is given a device number of 0, the system will revert to Mixed-signal mode.

Measuring Units Conversion

bar	PSI	mH_2O	Pascal	kPa	MPa
1	14.5	10.197	10^5	100	0.1

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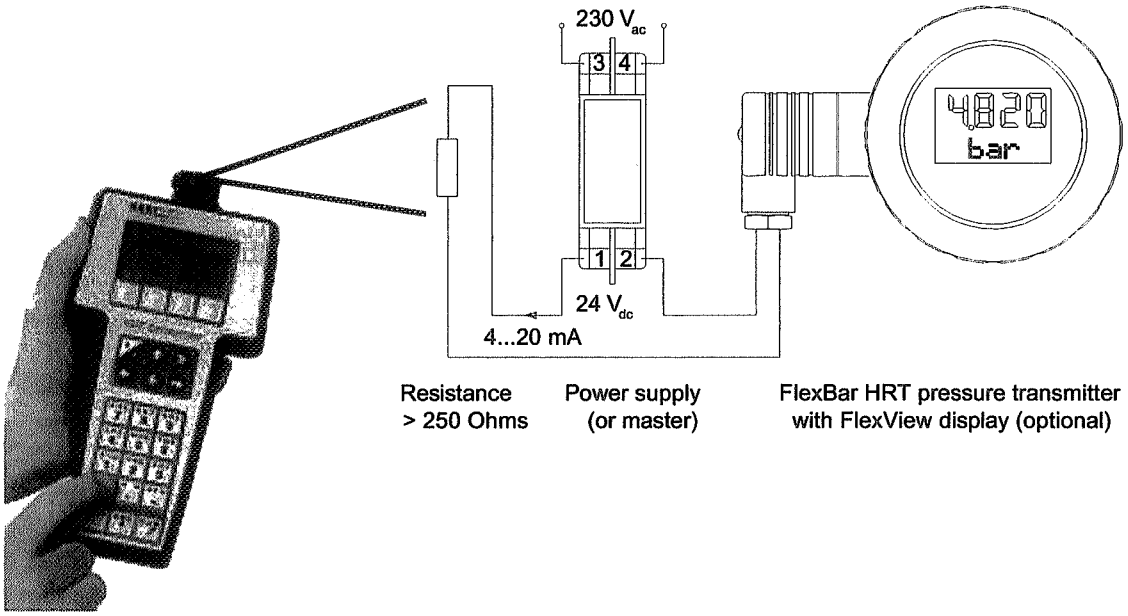
Hamworthy Moss AS

Part no: M5724-001txt Item:

Non-Ex-applicantion, Point-to-point



Resistance > 250 Ohms | Power supply (or master) | FlexBar HRT pressure transmitter with FlexView display (optional)

Handheld HART® communicator, model 275

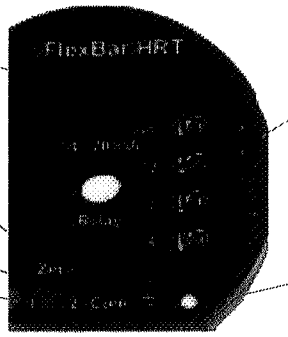
Electrical Connection

Screw terminals:
1 & 2: 4...20 mA loop
3 & 4: Opto-relay (optional)

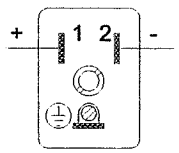
LED, lights during auto zero adjustment

Auto Zero push button

1 & 2: Pins for connection of FlexProgrammer



Connector DIN 43650 B



Test terminal:

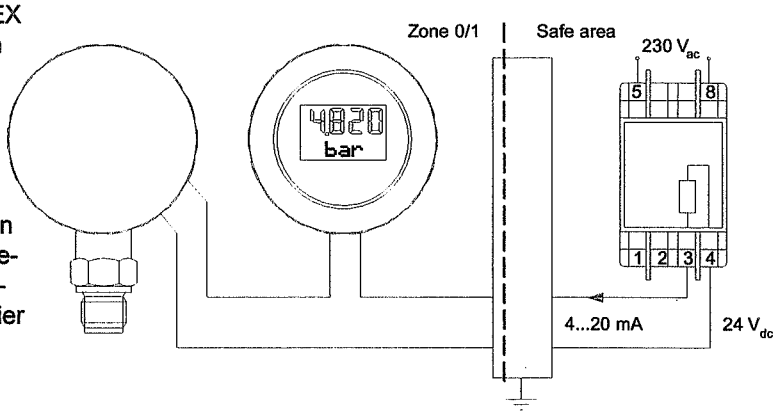
A multimeter (R_i < 2 Ohms) can be connected to measure the loop current without breaking the loop.

Ground connector

Ex-installation, Point-to-point

FlexBar HRT is approved by Demko for EEx ia IIC T5/T6 and ATEX II 1G according to the European standards EN 50014 and EN 50020.

FlexBar HRT is approved by Barbara for Ex ia IIC T5/T6. FlexBar HRT must be installed in accordance with prevailing guidelines for zone 0 or 1, and a certified, intrinsically safe zener barrier or isolation barrier with the maximum values
U_{max} = 30 V_{dc} ; I_{max} = 0.1 A ;
P_{max} = 0.75 W must be used.



FlexBar HRT | FlexView display (Optional) | Barrier | Power Supply (R_i > 250 Ohms)

FlexBar HRT is approved by Demko for Ex N IIC T5/T6 according to BS 6941:1988 for installation in zone 2 without a barrier

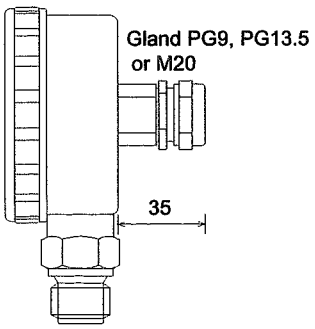
Hamworthy Moss AS

Part no: M5724-001txt Item:

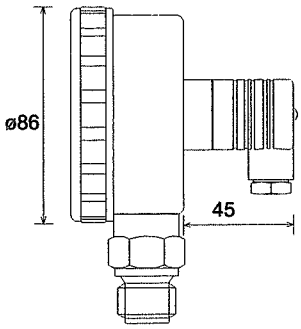
Dimensional Drawings

[mm]

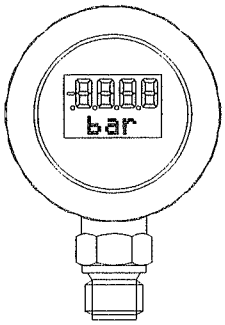
FlexView display is optional



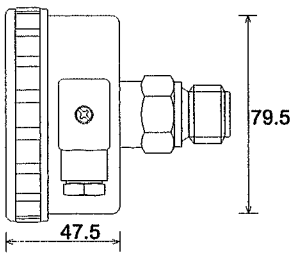
FlexBar HRT G1/2A, with gland
Process connection at the base
Side view



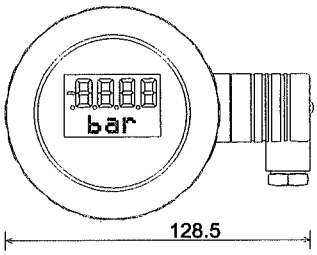
Process connection at the base
with plug. Side view



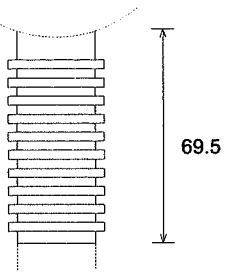
Process connection at the base
with display. Frontview



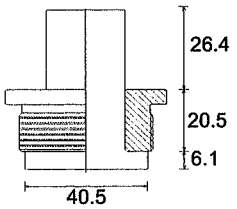
FlexBar HRT G1/2A, with plug
Process connection at the rear
Side view



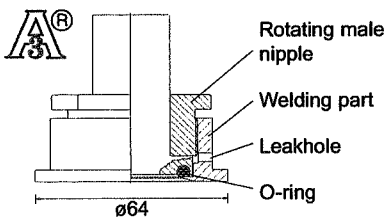
Process connection at the rear
With display and plug
Front view



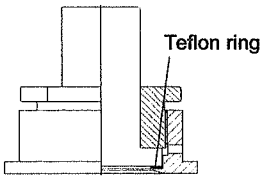
Cooling neck (integrated). Specify
mounting at the base or at the rear.
Add the indicated measure to height



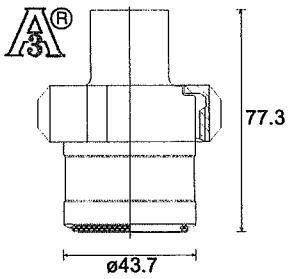
M44 x 1.25 connection with
cut through rotating male nipple



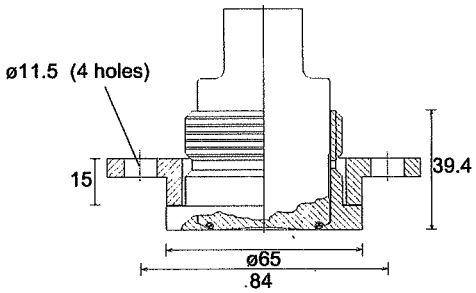
M44 x 1.25 hygienic connection
mounted in welding part



M44 x 1.25 pulp/paper version
mounted in welding part



ø43 mm connection with O-ring sealing
and DN25 rotating female nut (DIN 11851)



ø43 mm connection with O-ring sealing mounted in
welding part and with flange (shown without nut)

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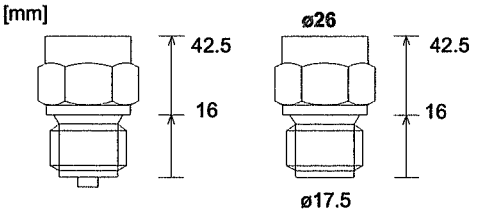
Hamworthy Moss AS

Part no: M5724-001txt Item:

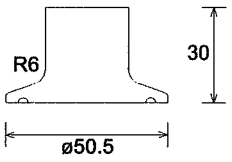
Dimensional Drawings

[mm]

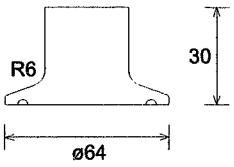


Gauge connection for external seal {5}

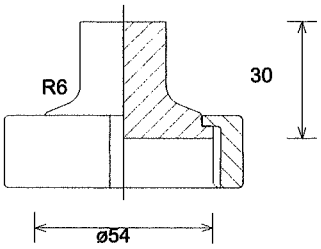
Male nipple G1/2A
Flush diaphragm



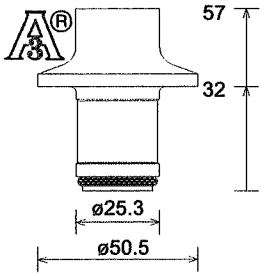
ISO 2852 clamp
DN38



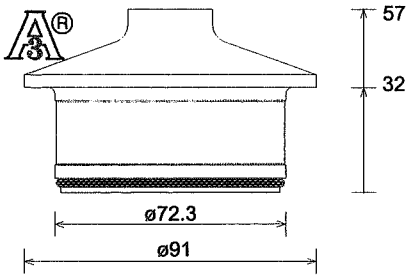
ISO 2852 clamp
DN51



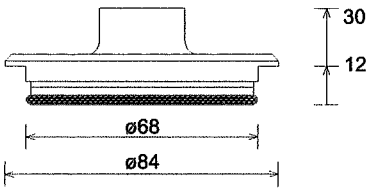
DS 722 rotating female nut, DN40



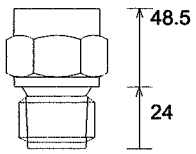
3A hygienic, DN38



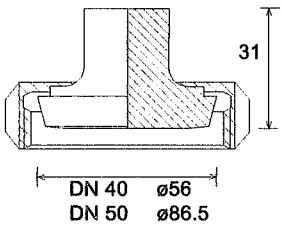
3A hygienic, DN76



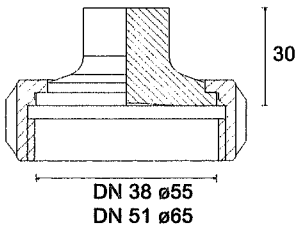
GEA Tuchenhagen Varivent



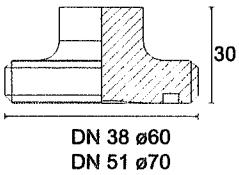
Male nipple 1/2-14 NPT



DIN 11851 rotating female nut



SMS 1145 Rotating female nut



SMS 1145 Male nipple

FlexBar HRT total measure:
Housing + (cooling neck) + connection

{5} This connection has no diaphragm and no oil filling. An external flange with seal and non-aggressive/non-conductive filling fluid must be mounted.

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Hamworthy Moss AS

Part no: M0085-001 Item:

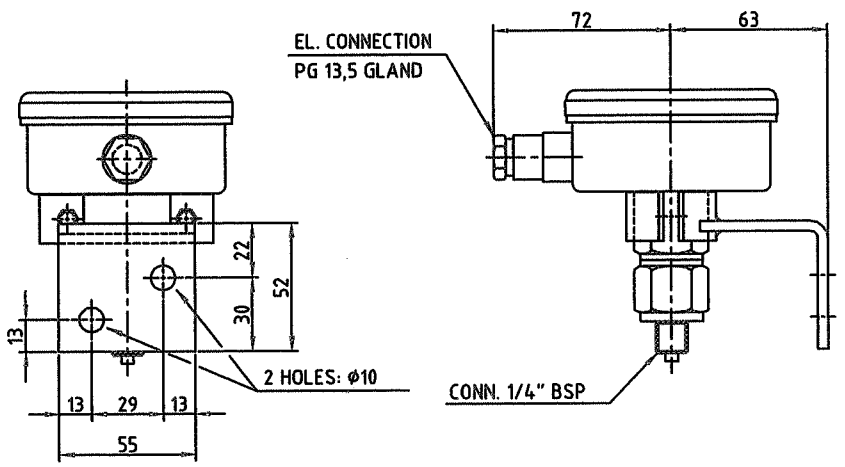
Rev: 01

Date: 20050527

BRACKET

FlexBar HRT Pressure Transmitter

This drawing and the know-how embodied in it are our property and must not, without our written permission, be copied or made available to others. The receiver is responsible for every misuse.



Forandringer: REV 00) 19991015/ UPPDATED TO JEEVES

Bygg nr. Yard No MOSS STANDARD	Ordre nr. Order No.	Tegn. Drawn	Tracef Traced TGK	Kontr. Checked	Godkj. App'd	Date Date 19991015	Skala Scale 1:2	Gruppe nr. Group. No. 6400	
Proj.metode Proj.method	MOSS INERT GAS SYSTEM						Erstn. for Replaces A4-8956	Erstattet av Replaced by	
Hamworthy KSE a.s, Moss Liquid Cargo Handling	Title PRESS. TRANSMITTER 81-611/612-121 WITH BRACKET						M2796-001std		Rev. 00
							Side Sheet 1 av of 1 sider sheets		Format A4

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Hamworthy Moss AS

Part no: M0171-001

FG: Item: 188

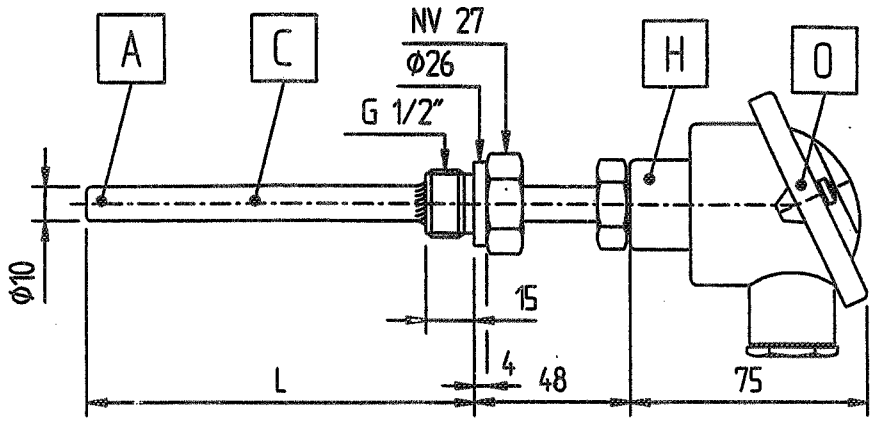
Rev: 01

Date: 20050601

PT100 - TEMP. TRANSMITTER

L=250mm, 0-100°C, 4-20mA

Connect: 1/2" BSP



Constructed basicly according to DIN43763 form B. Improved to ensure short response time and reliable measurement. Heat transfer conducted through metal all the way from the protection tube to the Pt 100 detector which eliminates the need for conduction compounds. Pt 100 detector built into ø6mm insert tube attached to standard terminal block to enable replacemant. Four wire attachment from detector leads to terminal block.

Specification

Protection tube

Seamless tube ø10 x 1mm, AISI 316/316L. Closed end is bushed with bore for ø6mm measuring insert. Short neck by the use of through protection tube.

Process entry

Male process entry thread G 1/2", AISI316/316L.

Cable entry

Weatherproof heavy duty die cast alloy screw top head type CE.

Insert

Replaceable, max ø6mm. Ceramic terminal block with spring loaded mounting screws alternately transmitter. Insert length according to DIN 43762 or ordering code. Max tip temperature normally 250°C.

A Pt 100 detector	C Max. temp.	H Terminal head	O El. connection	L Probe length	Insert length
DIN class B	250°C	Screw top CE, G 1/2" Neck length less 4mm	Transmitter Specified separately	250mm	325mm

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Hamworthy Moss AS

Part no: M8515-003

FG: Item: 182

Rev: 01

Date: 20050606

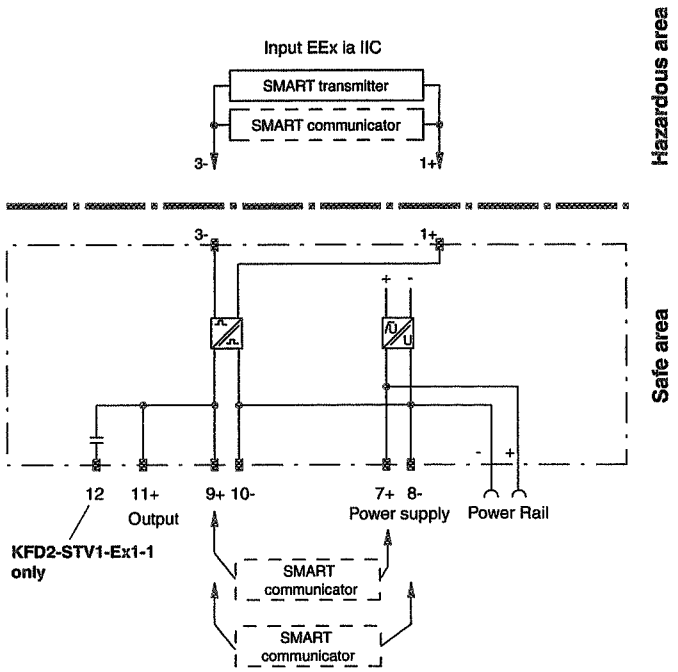
INTRINSIC SAFE RELAY

KFD2-STC1-Ex1

- 1-channel
- Input EEx ia IIC; U_0 = 28V
- 24 V DC nominal supply voltage
- SMART capable up to 12 kHz (-1 dB)
- EMC acc. to NAMUR NE 21

Output 4 mA ... 20 mA

KFD2-STC1-Ex1



Function

SMART transmitter power supplies provide SMART transmitters with power in hazardous areas and transfer the 4 mA ... 20 mA analogue values to output terminals 9+ and 10-.
The output signal for the KFD2-STC1-Ex1 is 4 mA ... 20 mA and the KFD2-STV1-Ex1-1 delivers 1 V ... 5 V. Digital signals may be superimposed on the analogue values in the hazardous or safe area, which may be transferred bidirectionally. Handheld terminals should be connected as shown in the block diagram. A series circuit, i. e. for the Bailey STT01, is also possible. SMART transmitter power supplies are delivered standard with terminals KF-STP-BU and KF-STP-GN. Jacks are integrated in these terminals for the connection of the handheld units.

Application

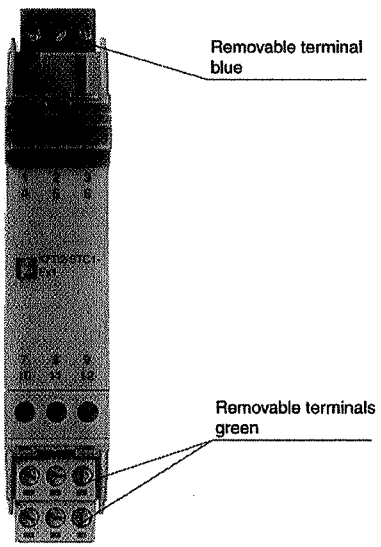
- The supply of power to SMART transmitters and the transfer of the measurement current to the output
- suited for the following SMART systems:

ABB	Chessel
Eckhardt-Foxboro	Endress+Hauser
Emerson	Fuji
Honeywell	Smar
Yokogawa	Siemens

Composition

Front View

Housing type A4
(see system description)



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Part no: M8515-003 Item:

Technical dat **KFD2-STC1-Ex1**

Supply		
Connection		Power Rail or terminals 7+, 8-
Rated voltage		20 ... 35 V DC
Ripple		within the supply tolerance
Power loss		0,8 W
Power consumption		≤ 1,2 W
Input		
Connection		terminals 1+, 3-
Input signal		4 ... 20 mA
Available voltage		at 20 mA: approx. 16,5 V at 200 Ohm output load dependent on output load: $U = 19.65 - (16.5 \times 10^{-3} \times R_B)$; with R_B = output load in Ohm
Output		
Connection		terminals 8-, 9+, 10-, 11+
Output signal		4 ... 20 mA , max. load 500 Ohm, with HART ≥ 230 Ohm
Ripple		≤ 75 μA_{ss}
Transfer characteristics		
Deviation		≤ 20 µA incl. calibration, linearity, hysteresis, loads and fluctuations of supply voltage
Influence of ambient temperature		≤ 20 p.p.m / K
Frequency range		hazardous area to safe area: bandwidth with 1 mA_{SS} signal 0 ... 12 kHz (-1 dB); 0 ... 30 kHz (-6 dB) safe area to hazardous area: bandwidth with 1 V_{SS}-signal 1 ... 12 kHz (-1 dB); 1 ... 30 kHz (-6 dB)
Rise time		40 µs
De-energised delay		40 µs
Electrical isolation		
Input/Output		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Input/power supply		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Output/power supply		not isolated
Directive conformity		
Electromagnetic compatibility		
Directive 89/336/EC		on request
Standard conformity		
Insulation coordination		acc. to DIN EN 50178
Electrical isolation		acc. to DIN EN 50178
Electromagnetic compatibility		acc. to EN 50081-2 / EN 50082-2, NAMUR NE 21
Climatic conditions		acc. to DIN IEC 721
Ambient conditions		
Ambient temperature		-20 ... 60 °C (253 ... 333 K)
Mechanical specifications		
Protection degree		IP20
Mass		approx. 150 g
Data for application in conjunction with hazardous areas		
EC-Type Examination Certificate		BAS 00 ATEX 7127 ; for additional certificates refer to the approval list
Group, category, type of protection		[EEx ia] IIC (T_{amb} = 60 °C)
Voltage	U_0	25,2 V DC
Current	I_0	93 mA
Power	P_0	586 mW
Type of protection [EEx ia]		
Explosion group		IIA IIB IIC
External capacitance		2,87 µF 0,79 µF 0,082 µF
External inductance		35 mH 17 mH 4,3 mH
Electrical isolation		
Input/Output		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Directive conformity		standards
Directive 94/9 EC		on request
Entity parameter		
Certification number		4Z6A5.AX
FM control drawing		No. 116-0129
Suitable for installation in division 2		yes
Connection		terminals 1, 3
Input I		
Voltage	V_{OC}	25,2 V
Current	I_t	93 mA
Explosion group		A&B C&E D, F&G

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Technical data

KFD2-STC1-Ex1

Max. external capacitance C_a		0,082 µF	0,79 µF	2,87 µF
Max. external inductance L_a		4,3 mH	17 mH	35 mH
Safety parameter				
UL control drawing		E 106378		
CSA control drawing		LR 65756-13		
Control drawing		No. 116-0132		
Connection		terminals 1, 3		
Input I				
Safety parameter		25,2 V / 270 Ohm		
Voltage	V_{OC}	25,2 V		
Current	I_{SC}	93 mA		
Explosion group		A&B	C&E	D, F&G
Max. external capacitance C_a		0,082 µF	0,79 µF	2,87 µF
Max. external inductance L_a		4,3 mH	17 mH	35 mH

Notes

Terminal 12 is placed across an internally applied capacitance. Active input cards such as Foxboro FMB 18, can be operated with this.

Hamworthy Moss AS

Part no: M8515-001 FG's Item: 187

Rev: 01

Date: 20050606

INTRINSIC SAFE RELAY

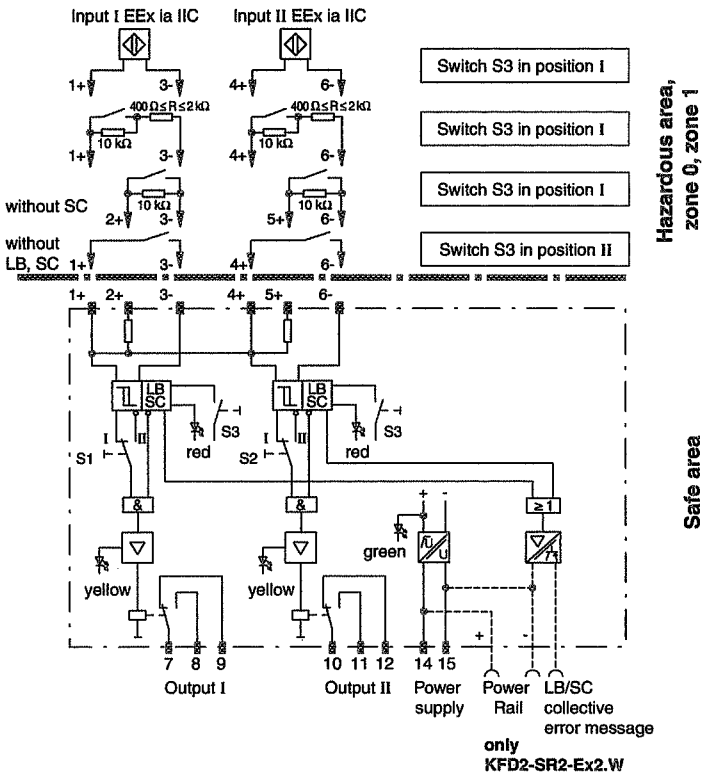
KFD2-SR2-Ex2.W

24 V DC

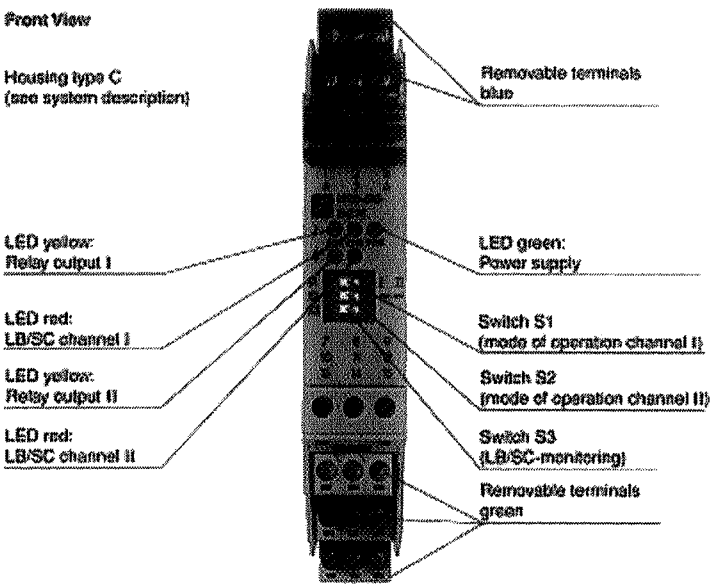
- 2-channel
- Control circuit EEx ia IIC
- Reversible mode of operation
- 1 signal output with 1 changeover contact per channel
- EMC acc. to NAMUR NE 21
- LB/SC monitoring
- LB/SC collective error message via Power Rail
- Usable up to SIL 2 acc. to IEC 61508

Function

The transformer isolated barrier transfers digital signals from the hazardous area. Sensors per DIN EN 60947-5-6 (NAMUR) and mechanical contacts may be used as alarms. Control circuits are monitored for lead breakage (LB) and short circuit (SC). The external faults are indicated according to NAMUR NE44 by a red flashing LED. For type KFD2-SR2-Ex2.W, an LB/SC collective error message is in addition transferred through the Power Rail to the power feed module. The intrinsically safe inputs per DIN EN 50020 are safely isolated from the output and the power supply. Relay outputs are galvanically separated from the mains power in accordance with IEC 61140. Relay outputs are galvanically separated from each other in accordance with IEC 61140.



Composition



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Part no: M8515-001 Item:

Technical Data

KFD2-SR2-Ex2.W

Supply		
Connection		Power Rail or terminals 14+, 15-
Rated voltage		20 ... 30 V DC
Ripple		≤ 10 %
Rated current		≤ 50 mA
Power loss		0,7 W
Power consumption		< 1,3 W
Input		
Connection		terminals 1+, 2+, 3-; 4+, 5+, 6-
Rated values		acc. to IEC 60947-5-6 (NAMUR, DIN 19234), see system description for electrical data
Open circuit voltage/Short-circuit current		approx. 8 V DC / approx. 8 mA
Switching point/Switching hysteresis		1,2 ... 2,1 mA / approx. 0,2 mA
Pulse/Pause ratio		≥ 20 ms / ≥ 20 ms
Lead monitoring		breakage I ≤ 0,1 mA , short-circuit I > 6 mA
Output		
Connection		output I: terminals 7, 8, 9 ; output II: terminals 10, 11, 12
Output I and II		signal ; relay
Contact loading		253 V AC / 2 A / cos φ > 0.7; 126.5 V AC / 4 A / cos φ > 0.7; 40 V DC / 2 A resistive load
Energised/De-energised delay		approx. 20 ms / approx. 20 ms
Mechanical life		10^7 switching cycles
Transfer characteristics		
Switching frequency		≤ 10 Hz
Electrical isolation		
Output/Power supply		reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff}
Output/Output		from january 2002 reinforced insulation according to IEC 61140, rated insulation voltage 300 Veff
Standard conformity		
Climatic conditions		acc. to DIN IEC 721
Directive conformity		
Electromagnetic compatibility		standards
Directive 89/336/EG		EN 61326, EN 50081-2, NE 21
Ambient conditions		
Ambient temperature		-20 ... 60 °C (253 ... 333 K)
Mechanical specifications		
Protection degree		IP20
Mass		approx. 150 g
Data for application in conjunction with hazardous areas		
EC-Type Examination Certificate		PTB 00 ATEX 2080 , for additional certificates see www.pepperl-fuchs.com
Group, category, type of protection		⟨Ex⟩ II (1) G D [EEx ia] IIC [circuit(s) in zone 0/1/2]
Input		EEx ia IIC
Voltage	U_0	10,5 V
Current	I_0	13 mA
Power	P_0	34 mW (linear characteristic)
Supply		
Safety maximum voltage	U_m	253 V AC / 125 V DC (Attention! U_m is no rated voltage.)
Type of protection [EEx ia and EEx ib]		
Explosion group		IIA IIB IIC
External capacitance		75 µF 16,8 µF 2,41 µF
External inductance		1000 mH 840 mH 210 mH
Statement of conformity		TÜV 99 ATEX 1493 X , observe statement of conformity
Group, category, type of protection, Temperature classification		⟨Ex⟩ II 3 G EEx nAC IIC T4 [device in zone 2]
Output		
Contact loading		253 V AC / 2 A / cos φ > 0.7; 126.5 V AC / 4 A / cos φ > 0.7; 40 V DC / 2 A resistive load (PTB 00 ATEX 2080) 50 V AC / 4 A / cos φ > 0.7; 40 V DC / 2 A resistive load (TÜV 99 ATEX 1493 X)
Safety maximum voltage	U_m	253 V AC (Attention! The rated voltage can be lower)
Electrical isolation		
Input/Input		not available
Input/Output		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Input/Power supply		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Directive conformity		standards
Directive 94/9 EU		EN 50014, EN 50020, EN 50021
Entity parameter		
Certification number		J.I.3002773
FM control drawing		No. 116-0035
Suitable for installation in division 2		yes

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Connection		terminals 1, 3; 2, 3; 4, 6; 5, 6		
Input I				
Voltage V_{OC}		12,9 V		
Current	I_t	19,8 mA		
Explosion group		A&B	C&E	D, F&G
Max. external capacitance C_a		1,273 µF	3,82 µF	10,18 µF
Max. external inductance L_a		84,8 mH	254,4 mH	678,4 mH
Safety parameter				
UL control drawing		E 106378		
CSA control drawing		LR 36087-19		
Control drawing		No. 116-0047		
Connection		terminals 1, 3; 2, 3; 4, 6; 5, 6		
Input I				
Safety parameter		12,6 V / 650 Ohm		
Voltage V_{OC}		12,9 V		
Current	I_{SC}	19,8 mA		
Explosion group		A&B	C&E	D, F&G
Max. external capacitance C_a		1,273 µF	3,82 µF	10,18 µF
Max. external inductance L_a		84,88 mH	298,7 mH	744,4 mH

Supplementary information

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. This information can be found under www.pepperl-fuchs.com

Accessories

PR-03 Power Rail
UPR-03 Power Rail
KFD2-EB2 power feed module
The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate combined fault indications.
Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.
If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.

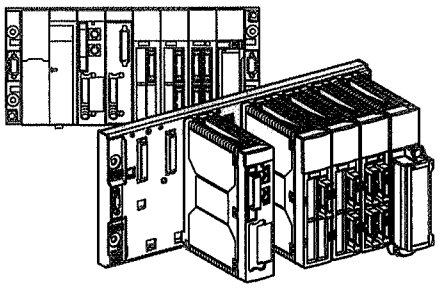
Hamworthy Moss AS

Part no: M6691-001 FG: Item: 235

Rev: 02

Date: 20070910

PREMIUM PLCs



General safety advice for users

1. General

This manual is intended for personnel technically qualified to install, operate and maintain the products which are described herein. For advanced use of these products please contact your nearest sales office for additional information.

The contents of this manual are not contractual and cannot under any circumstance extend or restrict contract warranty clauses.

2. Qualification of personnel

Only **qualified personnel** are authorized to install, operate or maintain the products. Any work performed by an unqualified person or non-observance of the safety instructions contained in this document or attached to the equipment may jeopardize the safety of personnel and/or cause irreparable damage to equipment.

3. Warnings

Warnings serve to prevent specific risks encountered by personnel and/or equipment. They are indicated in the documentation and on the products by different warning symbols:

Caution
Indicates that not following instructions or ignoring the warning may cause serious personal injury, death and/or serious damage to equipment.

Important or ⚠
Indicates that not following a specific instruction may lead to minor injury and/or damage to equipment.

Comment
Highlights important information relating to the product, its operation or its accompanying documentation.

4. Conformity of use

The products described in this manual **conform to the European Directives** (*) to which they are subject (CE marking). However, they can only be used correctly in the context of the applications for which they are intended (described in the various documents) and when connected to approved third party products.

(*) EMC and LV Directives, concerning Electromagnetic Compatibility and Low Voltage.

5. Installing and setting up equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes digital links, it is essential to follow the basic wiring rules, given in the manual "Electromagnetic Compatibility of Industrial Networks and Fieldbuses", **reference TSX DG KBLE**.

- Safety instructions must be followed meticulously. These instructions are in the documentation or on the equipment being installed and set up.

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- The type of equipment defines the way in which it should be installed:
  - a flush-mountable device (for example, a process control terminal) must be flush-mounted,
  - a device which is to be built in (for example, a PLC) must be placed in a cabinet or enclosure.
  - the casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed,
- If the device is permanently connected, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and be easily accessed. **The device must be connected to the protective ground.**
- If the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to the standards currently in force.
- Check that the supply voltages remain within the tolerance ranges defined in the technical characteristics of the devices.
- All measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a dangerous state which may place personnel or the installation at risk.
- Emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, when a wire becomes disconnected). Resetting these devices must not cause uncontrolled or improper restarts.
- Cables which carry signals must be located where they do not cause interference with the control system functions by capacitative, inductive or electromagnetic interference.
- Control system equipment and their control devices must be installed in such as way as to ensure that they are protected against unintentional operation.
- Appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6. Equipment operation

The operational safety and availability of a device is its ability to avoid the appearance of faults and to minimize their effects if they occur.

A fault inside the control system is known as:

- passive, if it results in an open output circuit (no command is sent to the actuators).
- active, if it results in a closed output circuit (a command is sent to the actuators).

From the safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm. An active fault is dangerous if it maintains or activates an undesirable command.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, whether they are indicated or not.

7. Electrical and thermal characteristics

Details of the electrical and thermal characteristics of devices are given in the associated technical documents (installation manuals, service instructions).

8. Maintenance

Troubleshooting procedure

- Control system equipment should only be repaired by qualified personnel (after sales service engineer). Only certified replacement parts or components should be used.
- Before performing any operation on equipment, always cut the power supply off and mechanically lock any moving parts.

Replacement and recycling of used batteries

Use batteries of the same type as the originals and dispose of defective batteries in the same way as toxic waste.

Part no: M6691-001 Item: 235

TSX/TPMXP571●/P573●/P574●□ processors

Presentation

A wide range of high performance, increased capacity processors is offered to best respond to the various user requirements.

- **TSX 57 sequential processors which can be integrated in TSX RKY●● racks:**
  TSX P57 102, TSX P57 202, TSX P57 252, TSX P57 302, TSX P57 352, TSX P57 402, TSX P57 452 processors
- **PMX 57 process control processors which can be integrated in TSX RKY●● racks:**
  TPMX P57 102, TPMX P57 202, TPMX P57 352, TPMX P57 452 processors

TSX/PMX 57 processors manage an entire PLC station comprising the discrete I/O, analog I/O and application-specific modules (counter, axis control, stepper control, communication, etc) distributed over one or more racks connected on X Bus.

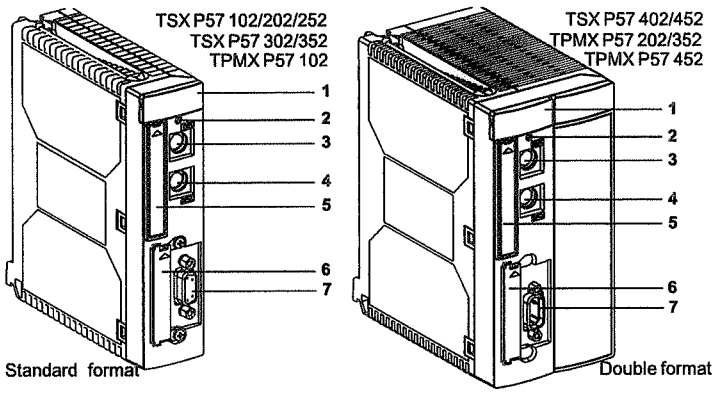
Each processor integrates:

- a protected internal RAM memory which can receive the application program and can be extended by a PCMCIA memory card (RAM or FLASH EPROM)
- a realtime clock
- 2 terminal ports (TER and AUX) which enable simultaneous connection of several devices (programming terminal , man-machine interface terminal, etc.)
- a slot for a PCMCIA communication card (Modbus+, FIPWAY, FIPIO Agent, UNI-TELWAY, serial links).
- a FIPIO master link on some processors

The application program is created using PL7 Junior or PL7 Pro software which offers:

- 4 programming languages
- a multitasking software structure (master task and fast task, event processing)
- modification of currently running programs, etc.

Physical description



1 Display block with 4 or 5 indicator lamps depending on the model:
   - RUN, ERR, I/O, TER lamps on all processors
   - FIP lamp on processors with an integrated FIPIO master link (TSX/TPMX P57●52)

2 Pencil-point RESET button which is used to activate a PLC cold restart.

3 TER terminal port for connecting a peripheral which may or may not be self-powered (programming or adjustment terminal, man-machine interface terminal, printer, etc).

4 AUX man-machine interface port for connecting a self-powered peripheral (programming or adjustment terminal, man-machine interface terminal, printer, etc).

5 Slot for a type 1 PCMCIA memory extension card.

⚠ **If there is no memory card, this slot has a cover which must be left in place; removing it will cause the processor to stop.**

6 Slot for type 3 PCMCIA communication card to connect the processor to a communication channel. If no communication card is present, this slot is fitted with a cover.

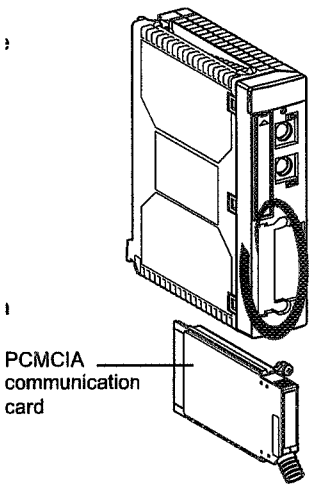
7 9-pin SUB D connector for connection to the FIPIO master bus. This connector is only available on TSX/TPMX P57 ● 52 processors.

- **Slot for PCMCIA communication card**

  This slot, on the front panel of the processor, can take a type 3 PCMCIA communication card:

  - TSX SCP 111: RS 232 D multiprotocol
  - TSX SCP 112: 20 mA current loop multiprotocol
  - TSX SCP 114: RS 485 multiprotocol, compatible with isolated RS 422
  - TSX MBP 100:Modbus+
  - TSX FPP 10/20: FIPIO Agent / FIPWAY

  ⚠ **The processor must always be POWERED DOWN prior to inserting or removing a communication card.**



- **Internal RAM memory**

  This memory holds the application (data, program and constants) and its capacity varies according to the type of processor:

  - 32 Kwords on TSX P57 102 processor
  - 48 Kwords on TSX P57 202/TPMX P57 102/202 processors
  - 64 Kwords on TSX P57 252/302 processors
  - 80 Kwords on TSX/TPMX P57 352 processors
  - 96 Kwords on TSX P57 402 processors
  - 96/112 Kwords[1] on TSX/TPMX P57 452 processors

  If the size of the application is greater than that of the RAM, it is possible to extend the memory by using a PCMCIA memory extension card. In this case, the program and the constants are memorized in the PCMCIA memory extension card and the data in the RAM memory.

  The internal RAM memory can be protected by an optional battery (TSX PLP 01), located in the power supply module. **The protection is only effective as long as the power supply and processor modules remain in the rack** (see duration of internal RAM memory protection).

- **PCMCIA memory card slot**

  This slot, on the front panel of the processor, can accept an optional type 1 PCMCIA memory card. **If the card is not present the cover must be kept in place.**

  2 families of cards are offered:

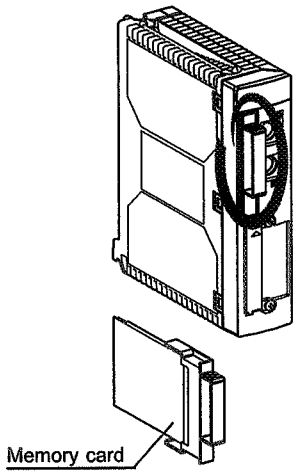
  - **Standard memory cards:** Two types are available:

    Protected RAM used during creation and debugging of the application program. The memory is protected by a removable battery integrated in the memory card.

1. When the application is stored in the internal RAM, memory capacity is limited to 96 Kwords. When the application is in the card, the capacity of the internal RAM memory is 112 Kwords.

FLASH EPROM when the application program is operational (debug completed)

- **BACKUP card** for loading the application program into the internal RAM memory, without using a terminal. This card must be loaded beforehand with the application program, the size of which should be less than 32 Kwords.



⚠ **A memory card can be inserted or removed with the POWER ON (causes a cold start). To become operational, a memory card must be fitted with a handle.**

If the program contained in the PCMCIA memory card includes the RUN AUTO option, the processor will start automatically in RUN after the card has been inserted.

References for standard and backup PCMCIA memory extension cards.

References	Type	Capacity	Compability with TSX/TPMX processors			
			P57 102	P57 2•2	P57 3•2	P57 4•2
TSX MRP 032P	RAM	32 K16	Yes	Yes	Yes	Yes
TSX MRP 064P	RAM	64 K16	Yes	Yes	Yes	Yes
TSX MRP 0128P	RAM	128 K16	No	Yes	Yes	Yes
TSX MRP 0256P	RAM	256 K16	No	No	Yes	Yes
TSX MFP 032P	FLASH EPROM	32 K16	Yes	Yes	Yes	Yes
TSX MFP 064P	FLASH EPROM	64 K16	Yes	Yes	Yes	Yes
TSX MFP 0128P	FLASH EPROM	128 K16	No	Yes	Yes	Yes
TSX MFP BAK032P	RAM/Backup	32 K16	Yes	Yes	Yes	Yes

- **RESET button**

  Using a pencil point to push this button causes the application to cold-start:

  - processor functioning normally: start in STOP or in RUN according to configuration,
  - processor faulty: forced start in STOP.

- **RUN/STOP function**

  This is used to start or stop the application program, from a programming terminal or from a discrete input defined during configuration. A stop command from this physical input takes priority over a run command from a terminal.

- **Realtime clock**

  The realtime clock integrated in the processor manages the current date and time as well as the date and time of the last application stop. This continues even when the processor is powered down, as long as it is mounted on

the rack with the power supply module, and protected by a battery.

⚠ **If the processor is removed the date and time information will be lost after a certain length of time (see below).**

- **Duration of backup of the internal RAM and realtime clock**
  - Battery backup period

Ambient temperature when not operating		≤30°C	40°C	50°C	60°C
Backup period	PLC off 12 hours/day	5 years	3 years	2 years	1 year
	PLC off 1 hour/day	5 years	5 years	4,5 years	4 years

  - Standby backup while the battery is being replaced (PLC off) or while a power supply module or processor is removed. Intervention time is limited; after a certain time, the data in the RAM memory may be lost.

Ambient temperature during power down	20°C	30°C	40°C	50°C
Backup period	2 h	45 min	20 min	8 min

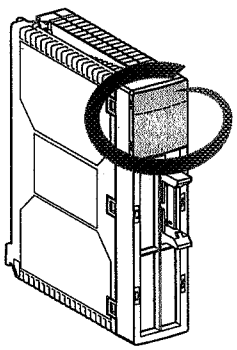
General introduction to discrete I/O modules

Maintenance/Diagnostics

The status lamps on the front panel of the module, enable fast diagnostics of the following:

- 3 module status lamps provide information on the module operating mode
  - **RUN** (green): module status (on: normal operation; off: faulty module)
  - **ERR** (red): internal faults (on: module failure; flashing: communication fault)
  - **I/O** (red): external faults (on: overload, shortcircuit, sensor/preactuator voltage fault; flashing: terminal block fault)

⚠ **During the self-tests the RUN, ERR and I/O indicator lamps flash.**

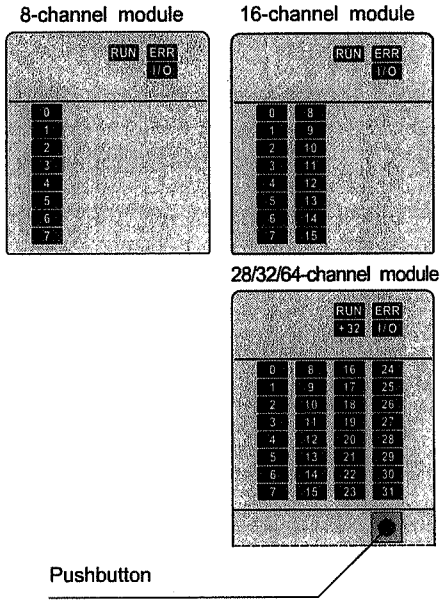


- 8, 16 or 32 channel status indicators give information on the status of every input or output (on: channel at state 1; flashing: faulty channel, overload or short-circuit; off:channel at state 0).

  In addition, the **+32** indicator, found on 64 channel modules, indicates the group of channels displayed (off: channels 0 to 31; on: channels 32 to 63). A pushbutton (only on 64-channel modules) is used to select the group of channels.

For mixed I/O modules with 28 I/O (16I + 12O):

- indicators 0 to 15 display the state of the inputs
- indicators 16 to 27 display the state of the outputs



Lamps \ Status	On ●	Flashing ⊗	Off ○
RUN	Normal operation	-	Module faulty or switched off
ERR	Internal fault module failure	Communication fault if RUN lamp on Module not configured if RUN lamp off (1)	No module fault
I/O	External fault: overload, short-circuit, sensor/preac-tuator voltage fault	Terminal block fault	No external fault
0...i	Channel at state 1	Faulty channel, overload or short-circuit	Channel at state 0
(1) This state is not available on module versions < V2.0. This function is currently only available on TSX DMY 28 FK modules.			

Part no: M6691-001 Item: 235

Operating conditions		
Operating temperature		0...60°C
Relative humidity		10...95% (without condensation)
Operating altitude		0...2000m
Withstand to	vibrations	IEC 68-2-6, Fc test, severity 2 g
	shocks	IEC 68-2-27, Ea test
Withstand to electrostatic discharge		IEC 1000-4-2, level 3
Immunity to	electromagnetic fields	IEC 1000-4-3, level 3
	rapid transients	IEC 1000-4-4, level3
	shock waves	IEC 1000-4-5
	damped oscillating waves	IEC 1000-4-12
Withstand to LF interference		IEC 1131-2
Storage temperature		-25...+70°C
Mechanical safety		IP 20 with TSX RKA 01 cover

Hamworthy Moss AS

Part no: N9095-001 Item: 256

Rev: 03 Date: 20070918

HYDRO CARBON / O2

ANALYSER PORTABEL

MODEL RX-415

Operation Manual for HC Gas use

Measuring Range:

HC: 0-100% LEL, 0-100vol%, O2: 0-25%

Model	RX-415	
Detection principle	Galvanic Cell	NDIR (non-dispersive infrared method)
Detection Gas	Oxygen (O2)	HC
Calibration Gas	Oxygen	Iso-buthane
Measurable range	0-25vol% (0.1vol%)	0-100%LEL/0-100vol% (Dual auto range) (0.5%LEL)/(0.5vol%)
Increment	Within +-0.7vol%(Follow to JIS T-8201)	+-5% of full scale (0-100%LEL) +-5% of full scale (0-100vol%) (Under same condition)
Response time	Within 20 sec. (T90, when sucked from gas inlet)	Within 30 sec. (T90, when sucked from gas inlet) Within 2 min (T90, when sucked from end of 30m hose)
Sampling	Suction pump	
Suction rate	Over 300ml/min	
Ambient temp/humidity	-10°C~40°C/below 90%RH (Non-condensing)	
Power source	Alkaline batteries (Size C) 4 pcs	
Continuous operation time	Approx 40 hours (No alarm/No light at 20°C)	
Explosion proof	Exiad II BT3 (pending)	
Dimension/weight	Approx. 200(W)x80(H)x142(D)mm/Approx. 2.0kg (Batt included)	

This instrument is an explosion-proof type portable gas detector which is designed to measure the presence of crude vapors in an inert gas or in air such as HC gas, vapors and methane gas and O2.

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Precaution in operation

- After reading this manual well, start to operate this instrument.
- Keep this manual where to carry out easily.
- When take out this manual by use of construction work, be sure to put it where it was.
- Do not use this instrument for no other than given purpose.
- When operate this instrument without using this manual or repair it by use of no other parts than the geniune one, the safety and quality of products could not be guarranteed. When any accident should take place by those irregular method, we cannot assume the responsibility for it.

Danger

This means that it gives the serious harm to the human life, body or material directly such as touching high voltage.

Warning

This means that it gives the serious harm to the human body or material if do not perform the operation according to the instruction manual.

Caution

This means that it gives the slight harm to the human body or material if do not perform the operation according to the instruction manual.

Note

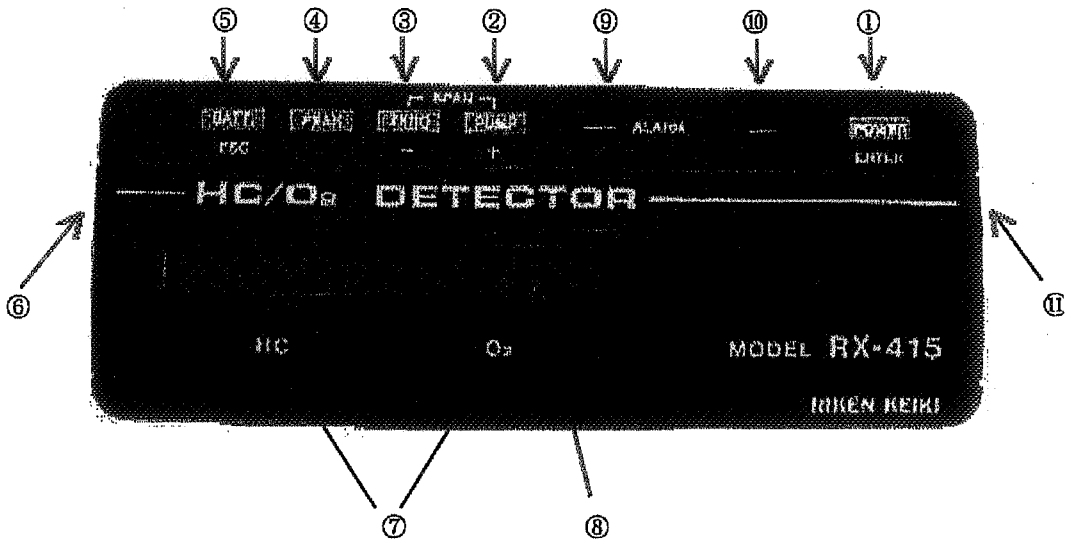
This means the advice in the operation.

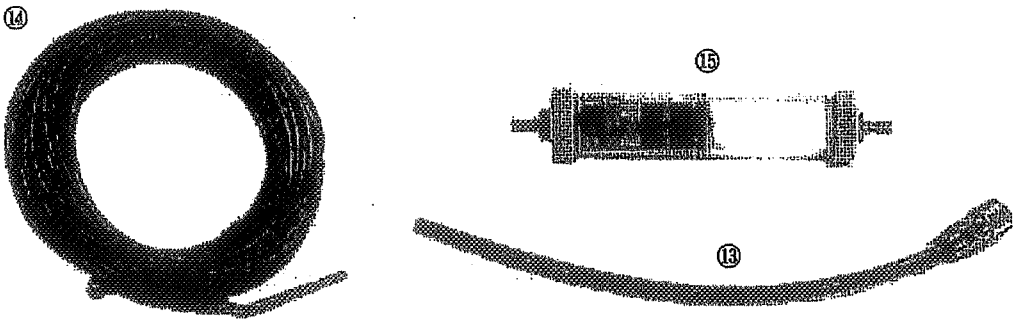
Name of each part

1. Power/enter switch
   This is used for the confirmation of power ON, OFF/input.
2. PUMP/(+) switch
   This is used for pump Switch ON/OFF and to increase the input valve.
3. ZERO/(-) switch
   This is used for zero adjustment and decrease the input valve.
4. PEAK switch
   This is used when desired to show the peak value.
5. BATT/ESC switch
   This is used when desired to show the battery voltage and cancel the input.
6. Gas Outlet
   This is the outlet to exhaust sample gas out.
7. Calibration gas name plate
   This shows the calibration gas name.
8. Display unit (LCD display with back light)
   This displays gas concentration.
9. Alarm lamp
   This flickers and lights on at trouble alarm time.
10. Photo sensor window
    This is for automatic back-lights of display unit by detecting that it gets dark around.
11. Gas inlet
    This is a measuring gas inlet.
12. Carrying case
13. Junction tube (20cm)
14. Gas sampling relay hose (29m) + Gas sampling hose (1m)
15. Filter tube with flowmonitor

Hamworthy Moss AS

Part no: N9095-001 Item: 256





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Part no: N9095-001 Item: 256

Operation

Check item before operation

Instrument:

- Check that there is no damage on the display unit.

Filter tube with flow monitor:

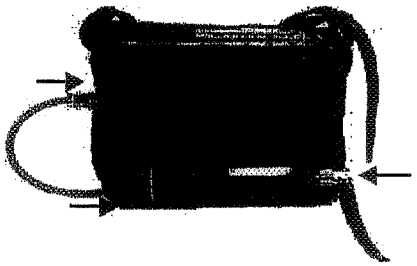
- Check the dirt of cotton and when it gets dirty, replace the cotton with new one.
- When the water drops are deposited, drain it out.
- Check that there is no crack or damage.
- Check that there is no looseness on the nipplie mounting.

Gas sampling hose:

- Check that there is no break or twist of it.

Preparation

1. Mount the battery into instrument.
2. Put the instrument into the carrying case.
3. Connect the instrument (gas inlet) the junction tube, filter tube with flowmonitor and gas sampling hose with instrument in turn.



As there are two types of head hoses for this instrument, use it according to the each environment.

Standard specification:
Gas sampling relay hose (30m) + Sampling hose Bar type (1m)

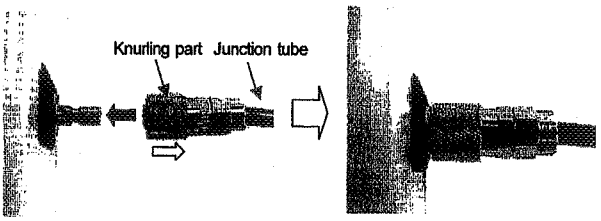
Optional specification:
Gas sampling relay hose (30m) + Sampling hose Floating type (1m)

Gas sampling relay hose and sampling hose (Bar type(Float type) is optional accessories.

Connection between gas sampling relay hose and model RX-415.

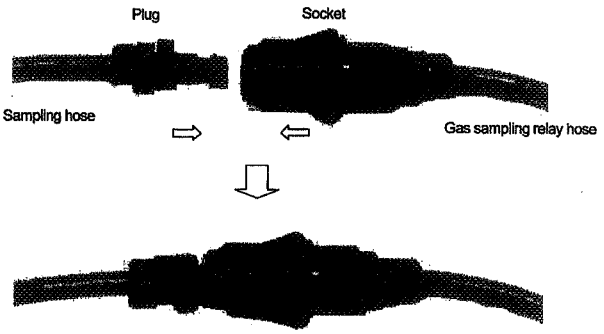
By holding knurling part with fingers, pull it to the arrow mark. ->

Plug in to the arrow mark <- with its condition. Release the fingers holding the knurling part and press in. Then, locked after ticking sound.



Connection between gas sampling relay hose and sampling hose 3.

By holding the socket of gas sampling relay hose and the plug of sampling hose by fingers and plug in to the arrow mark until it gets a ticking sound.



Warning

As this is used in dangerous zone, be sure to use it with carrying case.

Part no: N9095-001 Item: 256

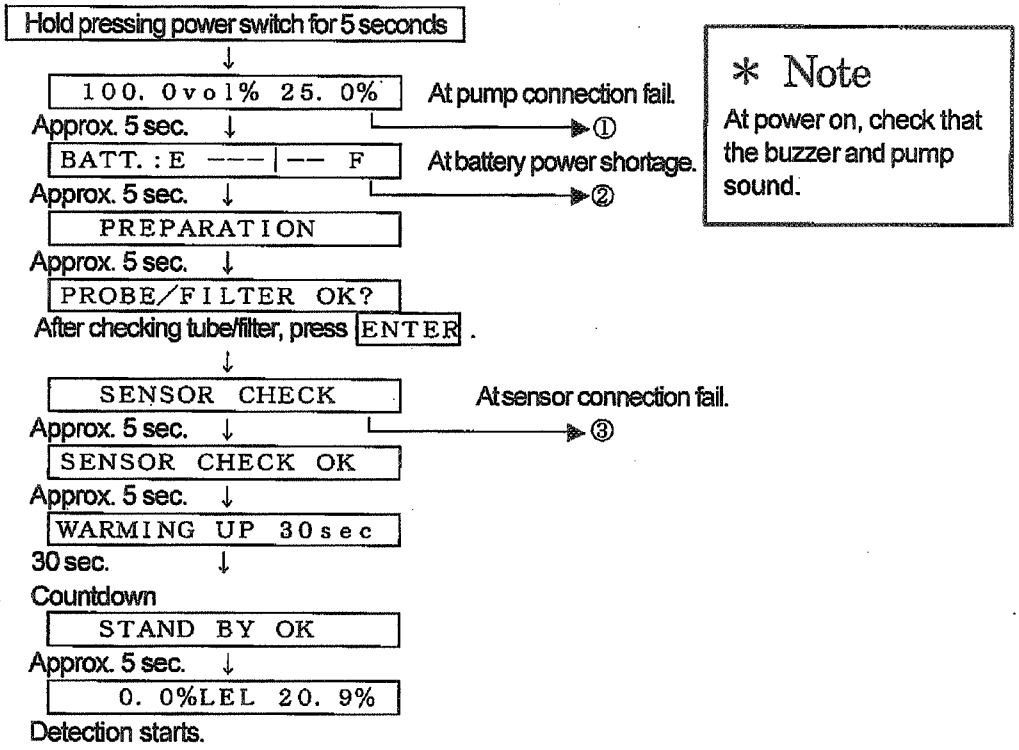
Caution

Be sure to plug in the gas sampling hose and junction tube. If not surely connected, the accurate measurement cannot be carried out.

Be sure to mount the filter tube with flowmonitor. If measure without filter, it will be a cause of trouble by sucking dust, water and oil, etc.

Start-up procedure

Hold pressing power switch for 5 seconds and the power will turn on. Via battery check, filter probe connection check and sensor connection check, the gas detection will start. The sequence performance until the gas detection starts is as follows:



* Note

At power on, check that the buzzer and pump sound.

① Display, performance at pump connection failure. (See 3.)

FAIL PUMP (Lamp : Light-on, Buzzer : Continuous)

② Display, performance at power voltage shortage. (See 3. and 5-1)

REPLACE BATTERY (Lamp : Light-on, Buzzer : Continuous)

③ Display, performance at sensor connection failure. (See 3.)

In case of HC sensor connection failure

FAIL SENSOR HC (Lamp : Light-on, Buzzer : Continuous)

In case of O2 sensor connection failure

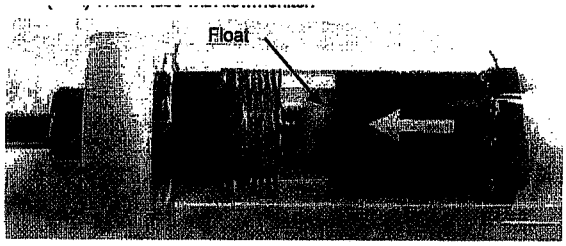
FAIL SENSOR O2 (Lamp : Light-on, Buzzer : Continuous)

In case of HC sensor/O2 sensor connection failure

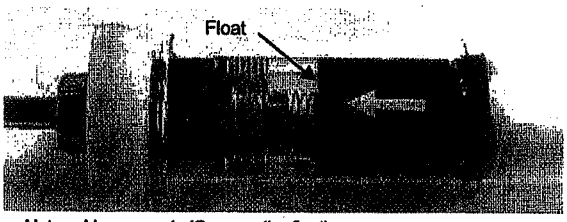
FAIL SENSOR (Lamp : Light-on, Buzzer : Continuous)

Check of flowmonitor

When turn on power, the pump starts working. Check that it works proberly by the flowmonitor (float) of filter tube with flowmonitor.



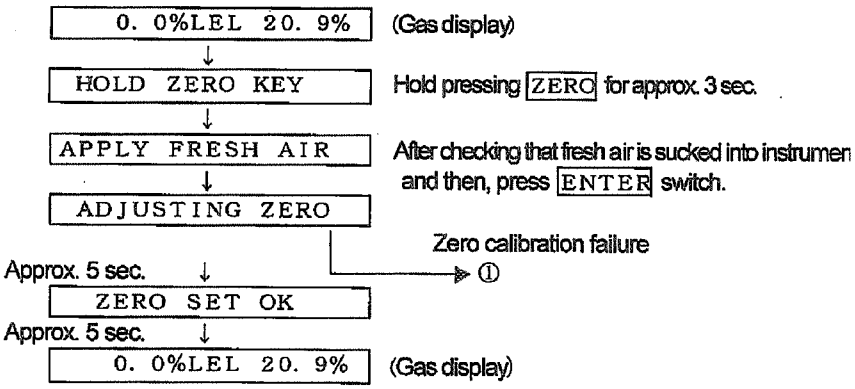
When sucking properly (Can see the float)



Not sucking properly (Can see the float)

Zero adjustment

Make zero adjustment by removing the gas sampling hose. After the detection starts, see the flow monitor and check that the air is sucked proberly. Then, check that the reading gets stable and make zero adjustment by sucking the fresh air into instrument. The operation procedure is shown below.



Display, performance at zero calibration failure

In case of HC zero cal. failure

FAIL ZERO HC/

In case of O2 zero cal. failure

FAIL ZERO /O2

In case of HC/O2 zero cal. failure

FAIL ZERO HC/O2

Caution

When make zero adjustment, do it after having fresh air sucked into instrument for over 1 minute. If zero point is adjusted under presence of gas, the accurate delection can not be carried

out, and oxygen deficiency accident may be occured.

Note

When desired to cancel the pre-operation, press ESC switch but after confirmed, it can not be cancelled.

Measurement

1. Measurement in tanks (Accessory 30m hose used)
   Fall down to the sampling point the gas sampling hose slowly by taking care of bending and twisting of hose. This sampling hose shows the length at every 5m and then, stop by seeing the distance at the position where dsired to measure.
   By the seeing the flowmonitor, check that it is sucked proberly. After stopping the sampling hose at the point where desired to measure and over 3 minutes have passed, read out the display reading.
   Whenever change the place of measurement, do the same procedure above.

Danger

There may be the oxygen deficiency at gas outlet point due to the inert gas. Do not breath at all. There may be the exhaust of high density gas (Above LEL). Do not approach the fire to it.

Warning

When the temperature is drastically changed at next detection point, in order to make accurate measurement, wait until the instrument accustom itself to its temperature (approx 10 min.). Then, start measurement after air calibration.

Warning

When measure O2 iniert gas, confirm that CO2 density of sucked air is under 15%. If over 15% of CO2 is introduced, that may decrease the sensor life.

Caution

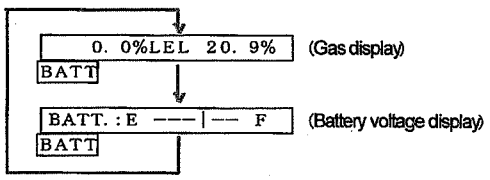
Do not let water or oil sucked into instrument. If it should be sucked, the pump or sensor shall be failed.
When measure, check the running sound of pump and flow monitors. It cannot be measured at stop of pump operation.
When the measuring gas is except calibration gas, the display reading will show at slightly high or slightly low side position.
Do not block the gas outlet because the display reading may show the slightly high position.

Note

When suck high density gas above LEL, the hang-up phenomenon takes place from the adsorption of it to the gas sampling hose and filter tube.

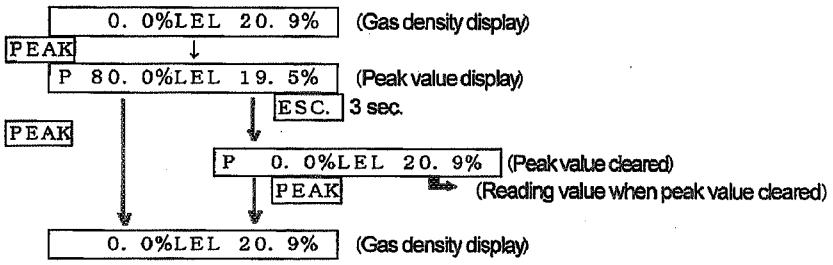
- When use the range of vol%, use it as it is.
- When make zero adjustment, remove the gas sampling hose and let fresh air sucked into instrument.
- When measure by %LEL range, clean the gas sampling hose by air and try to measure after the display reading goes down zero.

2. Battery voltage
   By pressing BATT switch while in operation, the battery voltage at present can be confirmed. The battery voltage will return to the gas concentration reading if there is no input of this switch "ON" for 20 seconds.



3. Read-out peak value
   When press PEAK switch in operation, this shows the peak value (Max point of reading for HC, minimum point of reading for O2)

from the power switch "ON" up to now. Then press PEAK switch again, the peak model is cancelled and returns to the measurement mode. Then if there is no input of peak for about 20 seconds, this shall return to the measurement mode. When hold pressing ESC switch for 3 seconds in the peak display, the peak value will be cleared.



Stop of pump operation

When transfer the sampling point or stop measurement temporarily, it can stop the running of pump only.
When stop pump running, the battery consumption can be cut by about 40% as compared with the pump running time. All except pump work and then, no warming-up time is required if re-operate the pump.

Note

When do not measure for some time, turn off the power.
As all except pump work, the battery will be consumed if leave the pump operation stopped.

(1) Pump running display

<Pump running on>

This displays gas reading while in pump running.

0. 0%LEL 20. 9%	(Pump running)

<Pump power off>

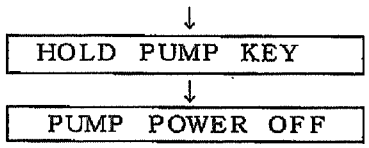
The following message shows while in pump work stopping.

PUMP POWER OFF	(Pump stop operation)

(2) Operating procedure

Pump : Running on → stop

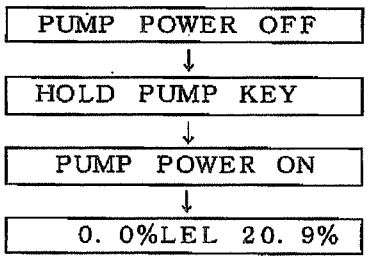
0. 0%LEL 20. 9%	(Pump running)



Press PUMP for about 3 sec.

(Pump stop operation)
Release PUMP switch after pump off.

Pump : Stop → Operation



Pump power off

Press PUMP for about 3 sec.

Display for about 5 sec. Release PUMP switch after pump running.

(Pump running)

Measurement completion

1. Treatment after measurement
   Roll up the sampling hose in a round bundle so that any bent or twist can not be made carefully. Make air cleaning for minimum 5 seconds until the reading comes nearby to zero point under condition that the sampling hose is connected with instrument by sucking fresh air.
2. Power OFF
   While pressing the power switch for about 5 seconds, the power will be off.

While pressing the power switch off, the buzzer will sound for about 15 times.

Caution

Do not forget to do air cleaning.
When neglect the air cleaning, the following will take place and will be a cause for trouble.

1. If water, oil and mist are left and condensed in dust, much of water and oil shall be sucked into instrument at the next measurement time.
2. As HC vapors may be absorbed completely, there will be a trouble for next time measurement.

Alarm function

Kind of alarm and alarm function
Trouble alarm is provided for this instrument.

Each alarm is provided with buzzer, lamp and display

Trouble alarm and alarm pattern				
		Lamp	Buzzer	
POWER ON	System Error	ON	Continuous	"SYSTEM ERROR"
	Battery power shortage	ON	Continuous	"REPLACE BATTERY"
	Sensor disconnection	ON	Continuous	"FAIL SENSOR" "FAIL SENSOR HC" "FAIL SENSOR O2"
	Pump disconnection	ON	Continuous	"FAIL PUMP"
Measurement	Low battery warning	Flicker	Intermittent	"B" flicker at left end
	Low battery alarm	ON	Continuous	"REPLACE BATTERY"
	ZERO cal. failure	OFF	No sound	"FAIL ZERO HC/" "FAIL ZERO /O2" "FAIL ZERO HC/O2"
	SPAN failure	OFF	No sound	"FAIL SPAN HC/" "FAIL SPAN /O2" "FAIL SPAN HC/O2"

Countermeasure at alarm

1. System Error ("SYSTEM ERROR")
   When receive an excessive noise, this error may appear.
2. When the low battery alarm is given, replace 4 pcs of batteries with new ones according to the procedure of "5-1. Battery replacement".
3. Sensor connection error
   When give an excessive shock or impulse to the instrument such as dropping or throwing, etc. and use for a long period, such display may appear. Carry out the daily check or regular check.
4. Pump connection error ("FAIL PUMP")
   When give an excessive shock or impulse to the instrument such as dropping or throwing, etc. and use for a long period, such display may appear. Carry out the daily check or regular check.
5. Zero cal. error ("FAIL ZERO HC/O2")
   Under the condition that zero gas(air) is not sucked correctly or water and oil etc are sucked into instrument, such displaymay appear. Check wether there is any damage or any sign of water or oil etc suction in the sampling hose or filter tube with flowmonitor etc. If any error could not be found, let zero gas(air) sucked into instrument correctly and make zero adjustment.
6. SPAN failure ("FAIL SPAN HC/O2")
   Under the condition that zero gas(air) not sucked correctly or water and oil etc are sucked into instrument, such display may appear. Check wether there is any damage or any sign of water or oil etc suction in the sampling hose or filter tube with flowmonitor etc. If any error could not be found, let calibration gas sucked into instrument correctly and make span adjustment.

Maintenance check

Battery replacement

Warning

Battery replacement shall be done at non-hazardous zone by all means.
Be sure to use the geniune batteries.

When make battery replacement, replace all 4 pcs batteries with new ones.

1. Check that the power OFF.
   When the power is ON, do it after power OFF.

2. Remove the carrying case from the instrument.
3. Open the battery cover by turning the screw on the bottom of instrument counterclockwise with minus screwdriver or coin, etc.
4. Remove 4 pcs batteries and put the new ones where they were by taking care of polarity.

NOTE

When remove battery, remove it from the polarity of (+). When put it, it is easy to replace the battery from the polarity (-).

5. When finish the replacement of batteries, put the battery cover in the reverse way.

Warning

Tight up the battery cover for sure.

Gas calibration

The measuring range of model RX-415 are dual expanded scale of 0-100%LEL and 0-100vol% for HC, and 0-25vol% for O2. Then, the gas calibration for all ranges is required.

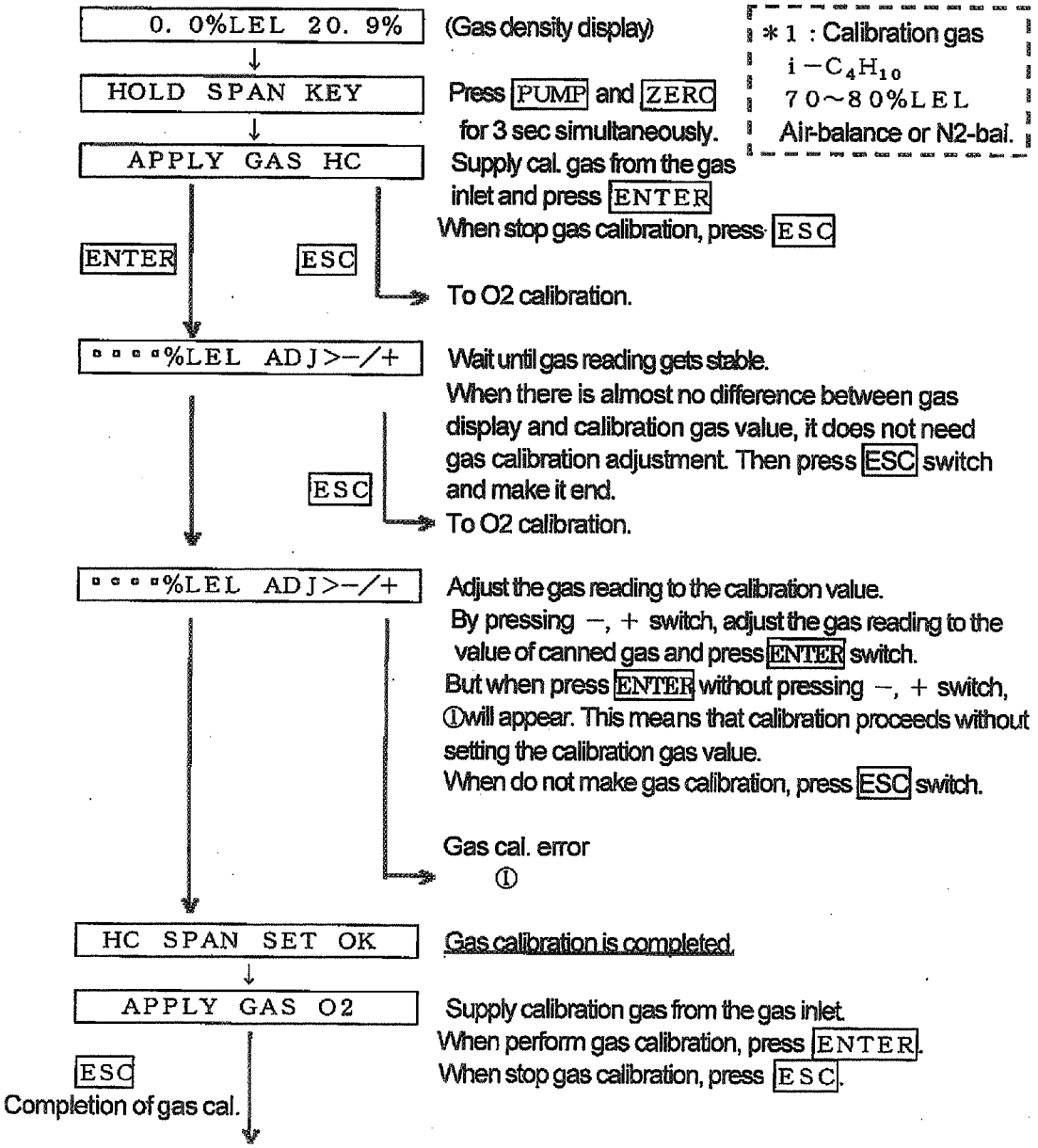
1. Prepare the calibration gas (both for low density gas and high desnity gas) and sampling bag.
2. Remove the filter tube and gas sampling hoses from the instrument. Then, arrange to connect sampling bag from the gas inlet of instrument.
3. Turn on the power and make zero adjustment.
4. Put the calibration gas*1 sampling bag and make gas calibration in the following procedure.

Danger

Do not approach the fire at the time of gas calibration at all.
For gas calibration, use the high density gas.

Note

Before gas calibration, confirm that the indication value is "0.0%LEL" after fresh air is sucked. Be sure to make zero adjustment when the value is not "0.0%LEL". End even though "0.0%LEL" is displayed, if it is flickered, zero point is deviated. Make zero adjustment.

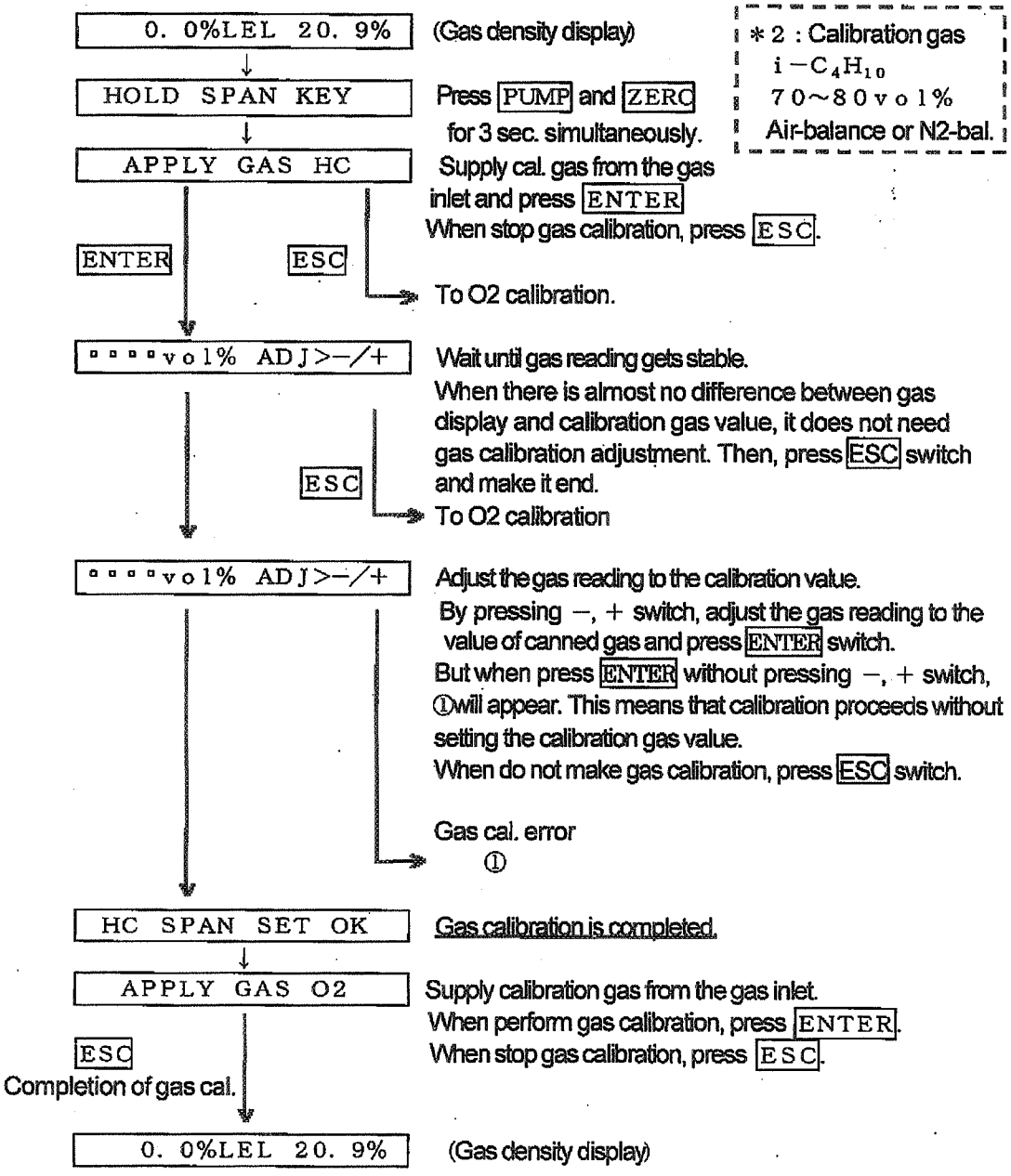


0. 0%LEL 20. 9% (Gas density display)

①Display and function in gas calibration error. (See 3)

FAIL SPAN HC/

Put the calibration gas*2 to sampling bag and make gas calibration in the following procedure.

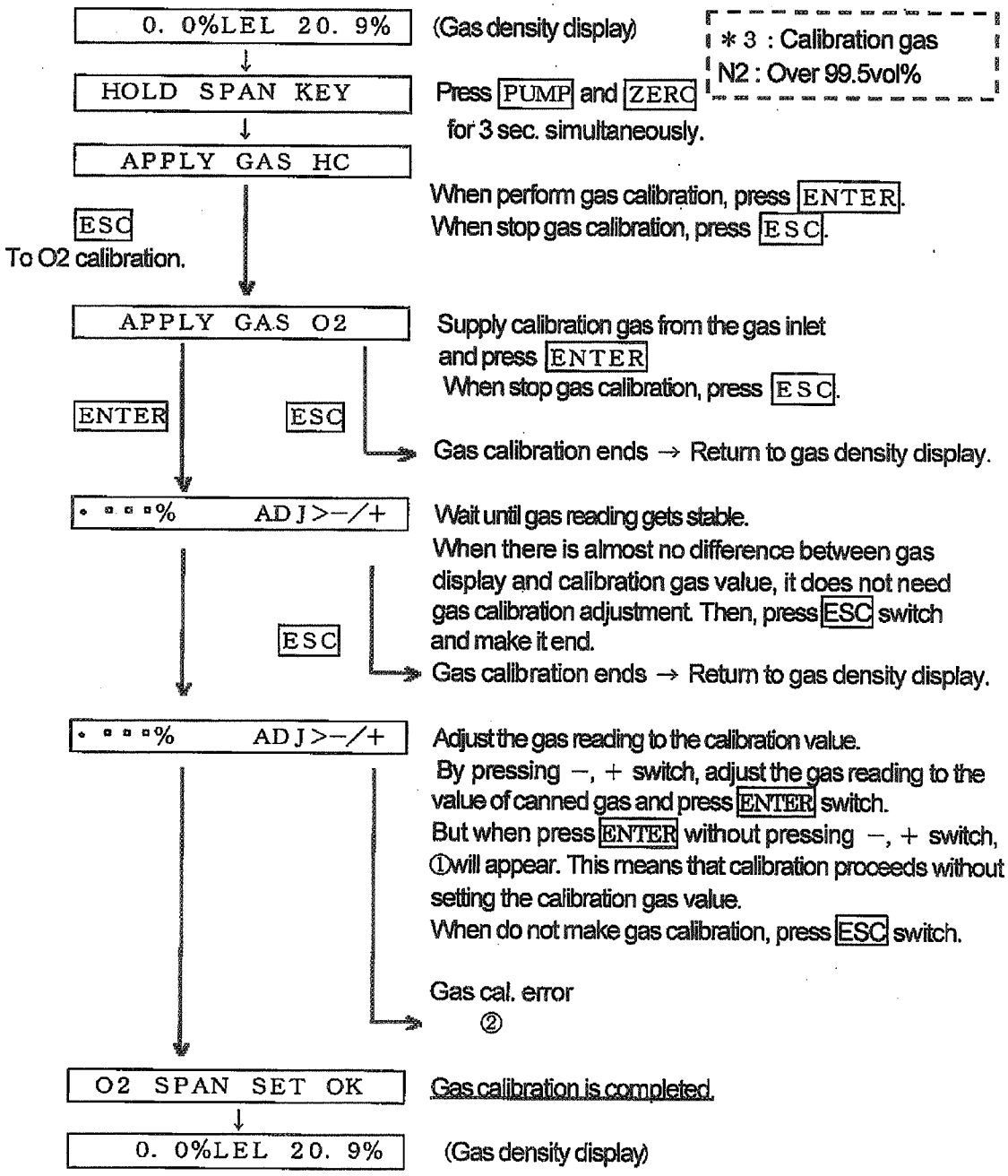


*2 : Calibration gas
$i-C_4H_{10}$
70～80vol%
Air-balance or N2-bal.

①Display and function in gas calibration error.

FAIL SPAN HC/

Put the calibration gas*3 to sampling bag and make gas calibration in the following procedure.



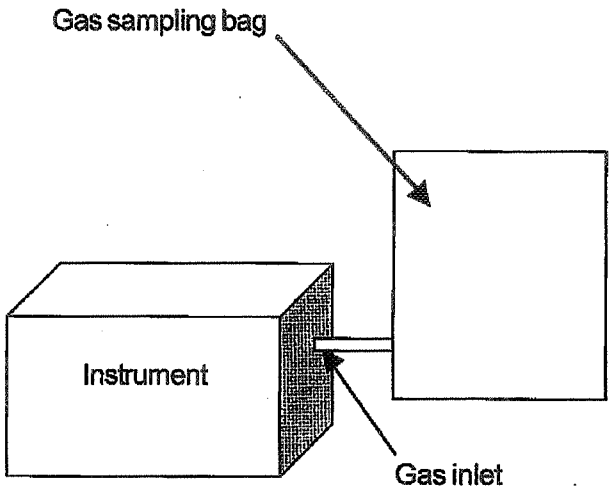
②Display and function in gas calibration error.

FAIL SPAN /O2

Caution

Do not supply the calibration gas directly by plugging in the gas inlet from the canned gas.

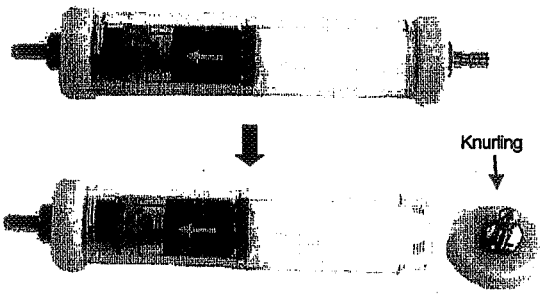
Because the inside of instrument may be damaged.
Be sure to make calibration by both high density gas and low density gas. If neglect this calibration, the accurate measurement cannot be assured.



Filter replacement

Check the filter (Cotton) in the filter tube with flowmonitor before measurement and if it is dirty, replace it with new one.

1. By turning the knurling part of the filter tube with flowmonitor, open the filter tube with flowmonitor.
2. Take out the cotton filter in the filter tube with flowmonitor by use of tweezers etc.
3. Put the new cotton filter so that it can be even in the filter tube with flowmonitor and close knurling part in the reverse procedure.



Caution

Do not put much of cotton filter.
If put in too much, the flow rate gets down and the accurate measurement cannot be carried out.

Note

Make this filter replacement in every month.

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O2 sensor replacement

O2 sensor life of RX-415 is approx. 1 year. If the following phenomenon would be occured, replace the sensor with new one. Sensor type is "OS-B3".

<Phenomenon>

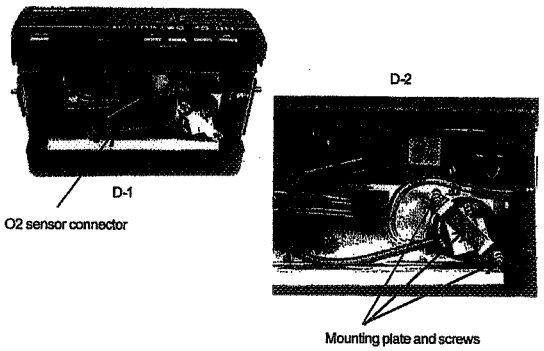
1. When "Calibration error" is displayed, even though the air calibration is performed by fresh air.
2. When the indication value can not be decreased even though human exhalation is introduced.
   When the indication is unstable. When it takes long time to get the stable indication.

Caution

Sensor life depends on utility condition and utility frequency.
Refrain to use the instrument under the condition that there is much dust, pressure alternation, excessive high/low temperature/humidity. These condition may decrease sensor life.

Replacement procedure

1. Remove the switch side cover by taking off 4 pcs of screws.
2. Pull out the connector from O2 sensor.
3. After removal of mounting screws and plate, O2 sensor can be taken off.
4. Take out spare O2 sensor from the case and take off cupper wire from connector. Then, connect O2 sensor to the instrument.
5. Sensor shall be installed in direction as D-2 by mounting screw (2pcs) and plate.
6. Put the cover back and mount 4 pcs of screws. Sensor replacement is completed



Daily check and regular maintenance check

1. Daily check
   Are there any damage on switches, lamp, display and panel?
   Pump suction work check (is pump suction sound normal? Can any trouble sound be heard?)
   Battery voltage check.
2. Regular maintenance check
   It is recommended to receive the maintenance check at least one in a year.
   Contact the nearest agent or Riken Keiki Co. Ltd.

Replacement of parts

As the following parts have its own end, it must be replaced regularly. When replace, contact the nearest agent ot Riken Keiki Co., Ltd.

Pump: Approx 2 years (Depend on use frequency)

Internal filter: Approx. 1 year (Depend on use frquency)

Sensor: Approx. 5 years

Storage and disposal when the instrument is not used for long time.

Storage under following conditions.

Temperature: 5-35°C

Humidity: 30-80RH

Place: Gas and solvent vaport are not existing.

Storage the instrument in the box where it was. When there is no storage box, storage in vinyl and etc.
Storage the instrument indoor escaping from direct sunshine. Take off the batteries when do not use for over 1 month.

Scrap of instrument

When scrap the instrument after a long use, do it in the same treatment as idustrial scrap goods (non-flammable goods) because no harmful material for environment is used except for O2 sensor. For scrap of O2 sensor, contact the nearest agent or RIken Keiki Co.,Ltd.

Troubleshooting

This trouble shooting does not mention the possible casue of all the malfunction but simply shows it to help the cause research of probable malfunction.

Trouble	Cause	Treatment
Power can not be on	-Empty batteries -Batteries are consumed up -Wrong polarity of battery -Time shortage to press Power switch	-Put batteries in correct way by seeing the battery replacement. -Hold pressing for approx. 5. sec. (Until displayed)
No pump running	No measurement and pump stops funning (Display comment)	Make re-operation of pump
No pump suction	The pipe of IN, OUT of filter or tube etc may be removed or clogged	Check the clog of filter pipe or twist etc and treat it correctly
Zero and span adjustment for O2 is not available	Is sensor life period in valid?	The validity of sensor is expired. Replace it to new one.
Zero "0.0"%LEL of gas display is flickering	Zero point is deviated	Check that there is gas free around and make zero adjust.
"100.0vol%" flickering	Zero point or gas sensitivity is deviated.	1. Make zero adjustment. 2. When not adjusted to reading value, make gas calibration.

Caution in operation

Keep the following items below to maintain the function of instrument and for safety.

Warning

Do not modify or alter the circuit or structure etc. After modyifyinf and altering the instrument, the function can not be maintained any longer.
As this is explosion-proof type instrument, make the battery replacement at non-hazardous-zone. The replacement at hazardous zone will be beyond the scope of explosion-proof concept.

As this is explosion-proof type instrument, be sure to operate with carrying case on.

Warning

Sensor life can be excessively reduced under the condition where acid gas and solvent gas are existing. In this case, make measurement as quickly as possible. After measurement, make sensor cleaning by introducing fresh air.

Caution

- Do not fall or crush it. As this is a fine instrument, the function may not be maintained if high impulse or shock is given.
- Do not splash water directly. As this is not drip-proof structure, it will be a cause for trouble if water is splashed directly.
- Do not give the elctrical noise during operation by strong walkie-talkie wave etc.When give the elctrical noise to the instrument, it will be a cause to damage the instrument.
- When the temperature in air is changed drastically, it may affect the reading of instrument.
- When it is in dew or condensed, the normal measurement can not be carried out.
- For internal filter and filter tube, be sure to operate it with them on by all means.

Note

- When measure the gas contains waterm suck it after removing water.
- When measure high temperature gas, make measurement after the instrument accustom itself to its temperature.

Definition of words

%LEL

When define the Lower Explosion Limit of combustible gas as 100%.
Methane: 100%LEL = 5. 0vol%
Iso-butane: 100%LEL = 1. 8vol%

vol%

This is the unit shown by percentage for how much a special material (or gas) in a volume is occupied in that volume.

Combustible gas

The lower limit of Explosive Limit (Explosive limit when mixed with air) is to be below 10%. The difference between upper and lower limits is to be above 20%.

HC gas

General name of hydrocarbon. This instrument displays it by converting through iso-butane gas density.

in Air

The atmosphere of -10 - +40°C, below 90%RH in an atmospheric pressure (0113hPa)

Hang-up phenomenon

This is the phenomenon to show slightly higher reading than the actual one by the influence residual gas for some while through fresh air is supplied after high density gas was sucked into instrument.

Oxygen deficiency

Phenomenon that may cause human healt disorder.

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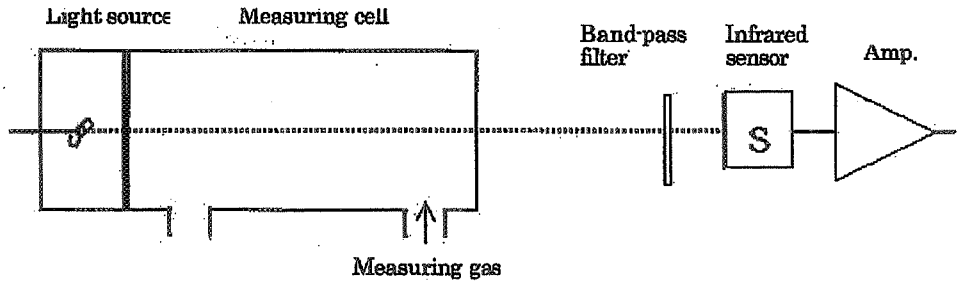
Detection principle

NDIR method (Non-Dispersive Infrared)

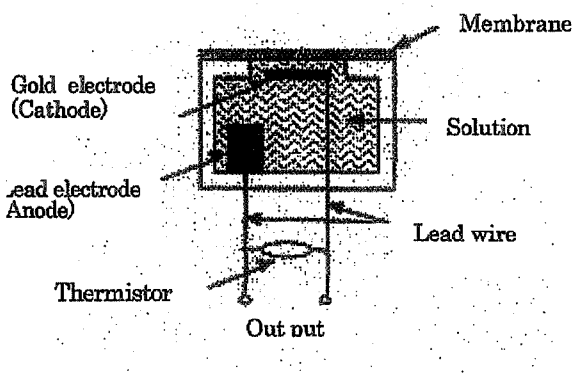
Model RX-415 is based on NDIR methos (Non-Dispersive Infrared) and this structure is shown below.

The infrared beam emitted from the light source passes through the measuring cell, and optical band pass filter which can pass the absorption wave of measuring gas and attains to the infrared sensor. The amount of infrared attaining to the infrared sensor through the measuring cell and will decrease according to its density.
The variable amount of infrared is measured by the infrared sensor and it is displayed as gas concentration.
Then, there is no sensivity against CO2 and CO etc which have the different absorption wave from the measuring gas. Then there is no sensitivity against N" and H" etc which cannot absorb infrared. As compared with the conventional catalytic combustion method, there is no poisoning material to be absorbed and almost no sensitivity drop on this detection principle.



GALVANIC CELL method

Galvanic cell is consisting of a lead anode and a gold cathode in electrolyte covered by a membrane. When oxygen enters into the gold cathode, a current which is directly proportional to the oxygen concentration will be produced, and amplified current will produce a reading on a meter in percent oxygen.



11 - 265

Hamworthy Moss AS

Part no: M1833-001

FG: Item: 262

Rev: 01

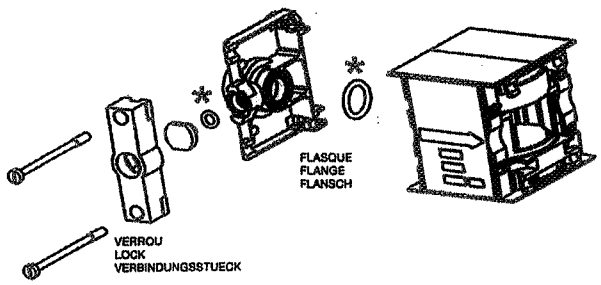
Date: 20050608

REDUCTION VALVE

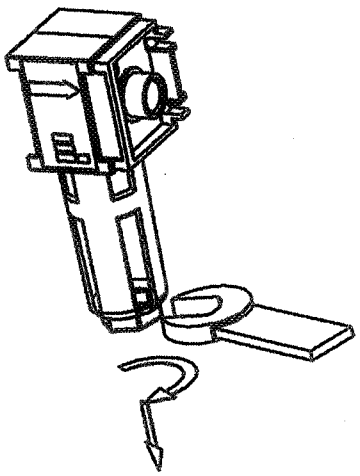
w/filter 1/2"

Serie C15 G1/2, 535 132 021 0

MONTAGE DES FLASQUES / MOUNTING OF FLANGES /

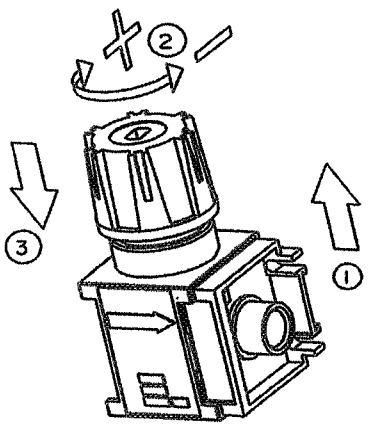


DEMONTAGE DES CUVES / BOWL REMOVAL /
DEMONTAGE DER BEHAELTER



REGULATEUR / REGULATOR

1. TIRER
   PULL
   ZIEHEN
2. REGLAGE DE LA PRESSION
   ADJUSTMENT OF PRESSURE
   DRUCKREGULIERUNG
3. VEROUILLER
   LOCK
   VERRIEGELN



☞ L'APPAREIL DOIT ÊTRE MIS HORS PRESSION AVANT TOUT DEMONTAGE DE CUVE

☞ THE DEVICE MUST BE DEPRESSURISED BEFORE REMOVING THE BOWL

☞ GERÄT MUSS DRUCKENTLASTET SEIN BEVOR DER BEHÄLTER ENTFERNT WIRD

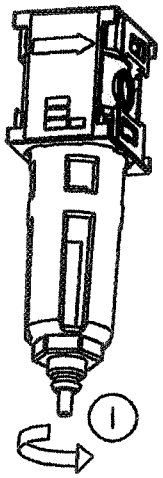
11 - 266

Hamworthy Moss AS

Part no: M1833-001 Item:

FILTRE / FILTER

PURGE MANUELLE
MANUAL DRAIN
MANUELLE ENTWAESSERUNG

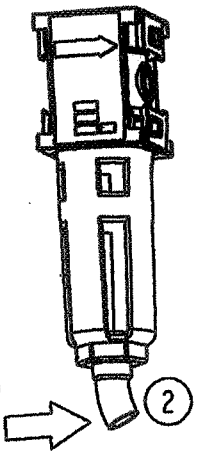


CE PRODUIT EXISTE AUSSI AVEC PURGE AUTOMATIQUE
THIS PRODUCT IS ALSO AVAILABLE WITH AUTOMATIC DRAIN
DIESER PRODUKT IST AUCH MIT AUTOMATISCHER ENTWASSERUNG ERHAELTLICH

LORSQUE LA CARTOUCHE FILTRANTE EST TROP ENCRASSEE, LA CHANGER
CHANGE THE FILTER ELEMENT IF IT BECOMES TOO CONTAMINATED
WENN DIE FILTER PATRONE VERSCHMUTZT IST, AUSWECHSELN

1. PURGE DU FILTRE : DEVISSER LA MOLETTE
   UNSCREW TO DRAIN FILTER
   ENTWAESSERUNG DES FILTERS : DIE SCHRAUBE OEFFNEN
2. COUPER LA PRESSION OU ACTIVER MANUELLEMENT
   INTERRUPT SUPPLY PRESSURE OR OPERATE MANUALLY
   DEN DRUCK AUSSCHALTEN ODER DAS GUMMIELEMENT SEITLICH DRUECKEN

PURGE SEMI-AUTOMATIQUE
SEMI-AUTOMATIC DRAIN
HALB AUTOMATISCHE ENTWAESSERUNG

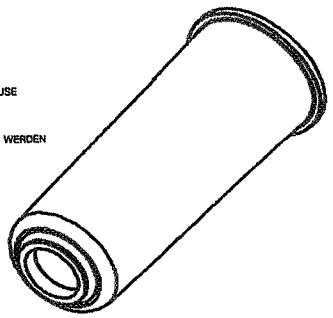


NETTOYAGE DES CUVES / BOWLS CLEANING

ATTENTION : LES CUVES DOIVENT ETRE NETTOYEES A L'EAU SAVONNEUSE

CAUTION : THE BOWLS MUST BE CLEANED WITH SOAPY WATER ONLY

ACHTUNG : DIE BEHAELTERS MUESSEN MIT SEIFENWASSER GEREINIGT WERDEN

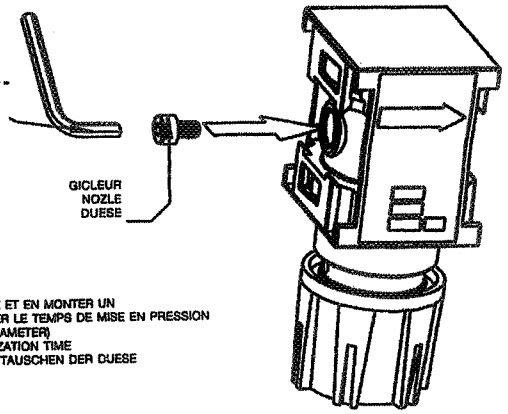


MISE EN PRESSION PROGRESSIVE / PROGRESSIVE START-UP VA VE

CLE 6 PANS DE 5 MM
6 MM HEXAGON SOCKET SPANNER
5 MM INNENSECHSKANTSCHLUESSEL

CHAVE PARA

GICLEUR
NOZZLE
DUESE



CHANGER LE GICLEUR MONTE D'ORIGINE ET EN MONTER UN DE DIAMETRE SUPERIEUR POUR DIMINUER LE TEMPS DE MISE EN PRESSION
CHANGE THE NOZZLE (USE A LARGER DIAMETER) IN ORDER TO DECREASE THE PRESSURIZATION TIME
REDUZIERUNG DER ANLAUFZEIT DURCH TAUSCHEN DER DUESE

Hamworthy Moss AS

Part no: M0255-001

FG: Item: 264

Rev: 01

Date: 20050601

VACUUM VALVE

DN15 - 1/2" Connecting BSP

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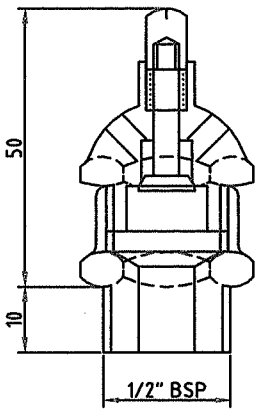

MATERIAL: BRASS

DIMENSION:1/2" BSP

SETTING: 300mmWG

Forandringer: REV 001 19990705/ UPPDATED TO JEEVES

Bygg nr. Yard No: MOSS STANDARD	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced: MLF	Kontr. Checked	Godkj. App'd.	Dato Date: 19990705	Skala Scale: ~	Gruppe nr. Group. No.: 6400	
Proj.metode Proj.method	MOSS INERT GAS SYSTEM						Ersatn. for Replacec: A4-7261	Erstattet av Replaced by	
Hamworthy KSE a.s, Moss Liquid Cargo Handling	Title: VACUUM VALVE 1/2" BSP ITEM 264						M2141-001std	Rev. 00	
							Side Sheet av 1 of sider 1 sheets	Format A4	

11-268

Hamworthy Moss AS

Part no: M0078-001

FG: Item: 265

Rev: 01

Date: 20050527

FLAME ARRESTOR

DN50 DIN PN10

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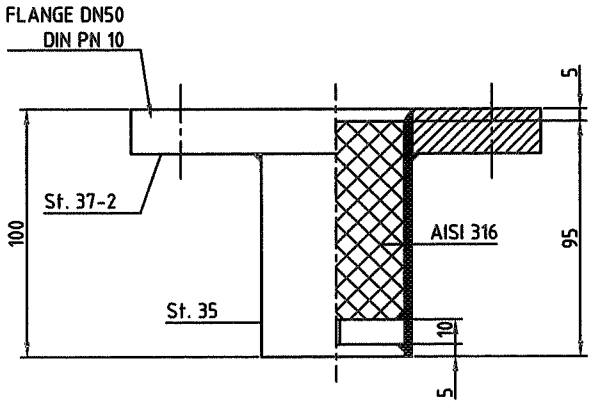

SURFACE TREATMENT:
EXTERNAL / INTERNAL

SANDBLASTING TO SA 2,5

COATING EXTERNAL:
1 COAT TWO PACK EPOXY: 75 MICRONES
1 COAT TWO COMPONENT EPOXY: 150 MICRONES
COLOUR: RED

COATING INTERNAL
1 COAT TWO PACK MODIFIED EPOXY: 300 MICRONES

WEIGHT: 3,5kg

Bygg nr. Yard No MOSS STANDARD	Ordre nr. Order No.	Tegn. Drawn	Tracet Traced MLF	Kontr. Checked	Godkj. App'd.	Dato Date 19990705	Skala Scale 1:2	Gruppe nr. Group. No. 6400	
Proj.metode Proj.method		MOSS INERT GAS SYSTEM					Erstn. for Replaces A4-7221	Erstattet av Replaced by	
Hamworthy KSE a.s, Moss Liquid Cargo Handling		Title FLAME ARRESTOR ITEM 265 DIN PN 10					M2143-001std	Rev. 00	
							Side Sheet 1 av of 1 sider sheets	Format A4	

Forandringen REV 00) 19990705/ UPPDATED TO JEEVES

11-269

MOSS INERT GAS ANALYZER

INSTALLATION GUIDE

Type: SBS3500-IG-M-AX4-HM

Hamworthy Moss AS • Vaerftsgt. • PO. Box 1053 • NO-1510 Moss • Norway

Tel.: +47 69279900 • Fax: +45 69254578 • e-mail: moss@hamworthy.com

Part no.: SBS3500– 00756.

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I Preface

I.1 About the Manual

This Manual contains data and instructions for the installation, operation and maintenance of the SBS 3500 Oxygen Monitoring System.

The instructions have been made in general terms and does not take into consideration the existing equipment and installation, as such the instruction manual is designed for the oxygen analyzer.

The Manual does not describe all possible situations but only the most common and known situations, and cannot replace the necessary instruction and education of the personnel.

Should situations not described in the Manual occur, which cannot be solved in accordance with normal known practice and good workmanship, the operator should contact Hamworthy Moss AS for instructions.

Hamworthy Moss reserves the right to minor alterations and improvements owing to developments without being obliged to enter the corresponding changes in this Manual.

In all correspondence or when ordering spare parts, be careful to state equipment type and fabrication no.

It should be pointed out that installation and operation of the SBS 3500 Oxygen Monitoring System and associated equipment should be carried out by skilled, trained and certified personnel, and that SBS Technology A/S does not take any responsibility of the operation of the system and associated equipment whatsoever.

I.2 About the System

The SBS_{3500} Oxygen Monitoring System is designed to measure the content of oxygen in Inert Gasses. The system is arranged on a common board and consists of the following main elements:

- Sampling manifold and test gas reduction stations

- Selector valve with four (4) position ports, enabling selection between e.g. three (3) sample point and one (1) calibration and test gases.
- Calibration gas selection with two (2) ports, enabling selection between two types of calibration gases, e.g. ambient 20.9% clean instrument air (span) and 2.0% test gas (zero).
- Sampling system with manual flow control valve, filer, bubble glass and oxygen sensor.
- Oxygen analyzing.

I.3 Company addresses

All claims, questions and inquiries for spares to be addressed to the supplier:

Hamworthy Moss AS
Vaerftsgt. 13
P.O. Box 1053
1510 NO-1510 Moss
Norway

Tel: +47 69279900
Fax: +47 69254578

E-mail: moss@hamworthy.com

I.4 Introduction to SBS_{3500}

The SBS_{3500} Oxygen Monitoring System is used to monitor the oxygen content in Inert gases. The compact design provides a wide range of configuration possibilities, outstanding performance and reliable on-line monitoring.

The SBS3500 is more than just an analyzer. Oxygen monitoring is also sample selection, sample conditioning, display and visualization.

The zirconium oxide oxygen analyzers have long been established as industry standards. The SBS_{3500} is based on a new type of industrial sensors, which can be used in a wide measuring range.

The sensor element is on one side exposed to the inert gas and on the other side to fresh air. Difference in oxygen concentration on the two sides of the zirconia ceramic element will at high temperature result in ionic flow through the sensor material. Because of the transportation of ions a small electrical voltage originates. The detected signal on the opposing surfaces of the zirconia sensor is a picture of the actual oxygen concentration in the sample gas and is used for further processing in the analyzer.

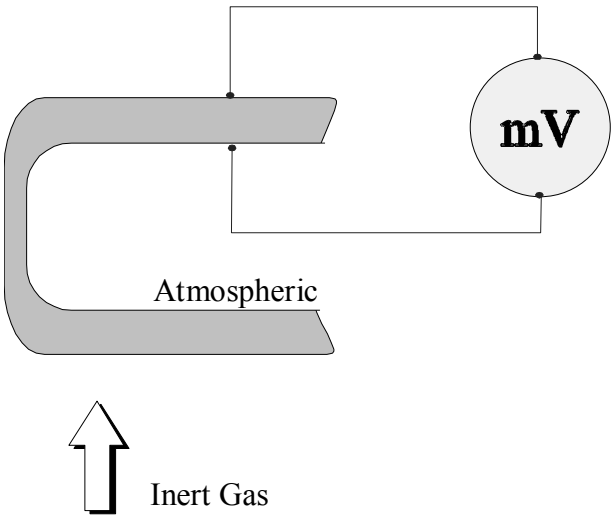

Figure 1. Transmitter

I.5 Specifications

I.5.1 Analyzer Board

Measurement system	*Heated Zirconia type sensor*
Measurement range	*0,2 to 21% (selectable range)*
Specification area	*@ 0 to + 55°C*
Sample pressure	*0.05 to 1 bar - 1/8"connection*
Sample temperature	*0°C to 65°C*
Digital display	*LED type 5 digits 17x 12 mm*
Power Supply	*220-230 VAC 50-60Hz or 110-130 VAC 50-60 Hz*
Consumption	*30 VA per analyzer (during calibration 50 VA)*
Output signal converter	*4-20 mA–range selectable of full measuring range*
Load output (Max.)	*20 mA/200 ohm/4 VDC*
System interface	*Calibration, run, 4 output relays, flow,*
Response time	*90 % of full scale in 10 sec.*
Repeatability	*0.1 % of reading*
Accuracy	*0.1 % of reading*
Alarm high or low O2 level	*Volt free relay 250 VAC/ 8A*
Zero adjustment	*Manual*
Span adjustment	*Manual*
Sample manifold	*3 ports - 1/8" connection*
Sample selector valve	*5-way and 4-position switching valve SS 316*
Test gas selector valve	*3-way and 2-position switching valve SS 316*
Span gas reduction regulator	*Pressure range: 0.2 bar to 8.5 bar - 1/8"connection*
Zero gas reduction station	*Pressure range: 0.2 bar to 8.5 bar - 1/8"connection*
Tubing	*SS 6/2 mm*
Flow control valve	*8 turn control valve*
Filter retention	*95% of 1µm particles*
Flow rate probe	*About 200 ml/ min*
Dimensions analyzing board	*600mm x 500 mm x 120 mm (H x W x D)*
Weight	*Approximately 11.0 Kg without water*
M.E.D. Conformity Marking	*EC Notification body no. 0062*

I.5.2 Optional equipment

Flow alarm,
Remote display with alarm relays
Visualization and data logging
Auto and self calibration
Monitoring of IGS temp. & pressure

For dimensions and assembly see appendix VI.4

Specifications subject to changes without notice

I.6 Type Approval

MARINE DIVISION
17 Bis Place des Reflets - La Défense 2
92400 Courbevoie - France
Tel. 33 1 42 91 52 91
Fax 33 1 42 91 28 94

BUREAU VERITAS

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File Number : AP 3597
MED item number : **A.1/3.30**
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EUROPEAN COUNCIL DIRECTIVE 96/98 EC on MARINE EQUIPMENT (M.E.D.)

EC TYPE EXAMINATION CERTIFICATE
(CERTIFICATE OF TYPE APPROVAL)

This is to certify that Bureau Veritas, acting within the scope of its notification , did undertake the relevant type approval procedures for the equipment identified below which was found to be in compliance with the International Instruments and testing standards under the requirements of Council Directive 96/98/EC, as amended.

OXYGEN ANALYSIS AND GAS DETECTION EQUIPMENT
SBS 3500 Oxygen Analyzer

MANUFACTURED BY:

SBS Technology A/S
Pandrup - DENMARK

REGULATIONS & STANDARDS in accordance with Council Directive 96/98/EC, as amended by Commission Directive 2002/75/EC :
SOLAS 74 Convention, as amended - Regulations II-2/4.5.7.1, II-2/4.5.7.2.1, II-2/4.5.7.2.2 - IMO Resolution MSC.98 (73)
FSS Code Chapter 15.2.4.2.4, EN 50104 (1999), IEC 60945(2002), EN 50270.

Expiry date: 11/03/2010

Local Office : BUREAU VERITAS FREDERICIA

BUREAU VERITAS SURVEYORS AT FREDERICIA PARIS 1828 NAB INTERNATIONAL REGISTER

At Paris la Défense, on : 11/03/2005

J.BENOIT
Marine Equipment Certification Manager
For BUREAU VERITAS, EC Notified Body N°0062

The Manufacturer is allowed to affix the MED Conformity Mark to approved equipment and issue a Declaration of Conformity, only when the production/product assessment module referred to in the Directive 96/98/EC, is fully complied with.
This Certificate remains valid until its date of expiry, unless cancelled or revoked, providing the conditions in the attached Schedule are complied with and the equipment remains satisfactory in service.This Certificate does not apply to equipment which has been modified from the specimen tested. Should the specified standards be amended during the validity of this Certificate, the product(s) is/are to be re-approved prior to it/they be placed on board vessels to which the amended standards apply.
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Issued under the authority of the French Maritime Administration.

BV mod. Ad.E 536 August 2001

IIInstallation

Read this chapter in its entirety before installing the system.

II.1 Control at delivery

Upon receipt of the SBS3500 Oxygen Monitoring System, inspect and confirm that the received scope of supply is in accordance with the packing list and not damaged. Any discrepancy should be reported to the suppler immediately. If any of the received parts are damaged the shipping company should be informed and new parts made available before completing the installation.

II.2 Location and installation

Satisfactory operation of the SBS_{3500}, faultless functions and minimal maintenance is achieved by paying attention to the following notes:

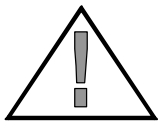
1. The equipment should be installed in a clean area away from dust, oil mist and moisture. The system elements should all be installed at viewing level in an area with good access for operating and servicing the system.

2. It is recommended that the analyzing panel is located near to the sampling point in order to have current and accurate readings. Long and large bore sample lines will increase the responds time due to dead volume.

3. The location and installation of the system must be chosen so that the ambient temperature at any time is below 55°C.

II.2.1 Safety Aspects

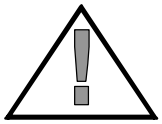
Warning!
The SBS3500 analyzer is only suitable for installation in a safe non-hazardous area.



Warning!
The SBS3500 analyzer is not suitable for use with flammable sample gases.

Warning!
Do not attempt welding or carry out hot-work without prior approval.

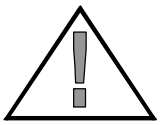
Warning
The O2 probe is hot and can cause severe burning to personals if not handled with care



Power supply!
Ensure that main supplies are switched off when connecting to the analyzer equipment. Read the instruction carefully to ensure correct connection of all power and signal leads.

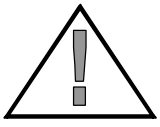
Ensure that the correct AC voltage is connected to the analyzer. See rating marked on the transformer inside the analyzer or on the analyzer name plate.

EMC
For compliance with the EMC product standard EN50270 the connection cables for the main supply, relays, interface and analog output signals should be shielded or provide equivalent protection. Special precautions have to be taken for "long" signal or control lines of more than 30 M.

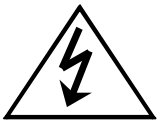


Circuit breaker!
The installation must include a means of isolating electrical power by a switch or circuit breaker external to the analyzer and within reach of operator. It must be clearly marked.

Installation and fault Finding!
Electrical installation and fault finding on the analyzing system should only be undertaken by a suitable trained and qualified engineer.



Protective earth!
The analyzer must be connected to protective earth.



Connections!
All electrical connections and power supply fuse FUH-1, are accessed on the lower part of the power board inside the analyzer. To gain access the top cover on the analyzer must be unbolted using standard 6-8 mm screwdriver. To work on the analyzer or termination the interconnection ribbon may be disconnection on the based board.

II.2.2 Electrical connections

Full specifications to the connection terminals are given in following connection table II.

Only those functions to be used shall be connected.

Power Supply – connections (JS-1)		**Terminals-marking**
AC power supply **Selectable by transformer 110** **VAC or 220 VAC 50/60 Hz** **30 VA maximum**	**Protective earth** **Neutral** **Live**	**Spade** **N** **P**
Oxygen sensor – connections (JS-2)		**Terminals-marking**
Sensor outer electrode	**IPE – Sensor 1**	**JS-2 terminal 1 (Brown) 1**
Sensor inner electrode	**VM – Sensor 2**	**JS-2 terminal 2 (White) 2**
Sensor reference electrode	**UN – Sensor 3**	**JS-2 terminal 3 (Blue) 3**
EMC screening	**Ground**	**JS-2 terminal 4 (None)**
Sensor heating	**U+ sensor 4**	**JS-2 terminal 5 (Black) 4**
Sensor heating	**U- sensor 5**	**JS-2 terminal 6 (Gray) 5**
Interface – connections (JS-3)		**Terminals-marking**
Analog output	**0/4-20 mA (+)**	**JS-3 terminal 1**
Analog output	**Common AGND (-)**	**JS-3 terminal 2**
AUX. Input 1	0-22 mA(+)	JS-3 terminal 3
AUX. Input 1	Common AGND (-)	JS-3 terminal 4
AUX. Input 2	0-22 mA (+)	JS-3 terminal 6
AUX. Input 2	Common AGND (-)	JS-3 terminal 8
AUX. Input 3	0-22 mA (+)	JS-3 terminal 7
AUX. Input 3	Common AGND (-)	JS-3 terminal 8
Digital input opto. supply	Common 12 V sup-ply	JS-3 terminal 5
Digital input opto supply	to opto-coubler	JS-3 terminal 9
Digital input 1	Calibration gas span	JS-3 terminal 10
Digital input 1	OK (closed)	JS-3 terminal 14
Digital input 2	Calibration gas zero	JS-3 terminal 11
Digital input 2	OK (closed)	JS-3 terminal 14
Digital input 3	IGS running signal	JS-3 terminal 12
Digital input 3	OK (closed)	JS-3 terminal 14
Digital input 4	Start calibration	JS-3 terminal 13
Digital input 4	Start (closed)	JS-3 terminal 14
Relay – connections (JP-1)		**Terminals-marking**
Relay 1 - Auto calibration	Zero cal.	JP-1 terminal 1
Relay 1 – Open during zero cal.	Zero cal.	JP-1 terminal 2 (common)
Relay 2 – Auto calibration	Span cal.	JP-1 terminal 3
Relay 2 – Open during span cal.	Span cal.	JP-1 terminal 4 (common)
Relay 3 – Auto calibration	Sample valve	JP-1 terminal 5
Relay 3 – Closed during cal.	Sample valve	JP-1 terminal 6 (common)
Relay 4 – Alarm output	**Alarm common**	**JP-1 terminal 7**
Relay 4 – Alarm output	**Alarm common**	**JP-1 terminal 8**

Table II.2.2

*Connection's in **BOLD** are basic connections. All other connections are to be considered optional.*

II.2.3 Analyzer Board

The analyzer board is supplied with two (2) angle iron mounting brackets. The brackets are made from ordinary mild steel and can bee directly welded or bolted to chosen location structure as required. For dimensions and layout see appendix VI.4

The two mounting brackets must be mounted horizontal and parallel with a distance of 580 mm.

II.2.4 Connection

Assuming the above Boards is now installed in an appropriate location, we are now ready to connect the system with sample gas, calibration gas and power.

Connection of sample gas 1 and sample gas 2

II.2.5 Sample gas connection

The sample gas has to be taken from a suitable location representing the gas to be tested.

The connection for sample gas is arranged on the left upper corner of the system board at the sample manifold. Up to three (3) samples can be connected to the manifold. The three connections are all arranged as 1/8" female connection's, and marked from bottom 1, 2 and 3. The system is supplied with the manifold sample port 2 and 3 plugged.

Connection of span and zero calibration gas.

II.2.6 Calibration gas connection

For test and calibration a calibration gas with known oxygen content is used, e.g. a test gas with 2% oxygen content in pure nitrogen. For linearization or span clean and dry compressed instrument air are normally used. Both gasses are connected direct to respective reduction stations. The lower reduction station with filter and drain is for the span gas (instrument air) and the upper reduction station without filter is for the zero gas. Connections for both reduction stations are 1/8" female connection's.

II.2.7 Electrical connection

The electrical connection's are dependant on the actual system configuration. The connection terminals are all located on the lower part of the power board. The terminals are marked as follows:

- Power supply (JS-1)
- Oxygen sensor (JS-2)
- Interface connections and I/O's (JS-3)
- Relay outputs: (JP-1)

For further reference see appendix VI and table II.2.2

Power supply

Before connecting the power supply to terminal JS-1 terminal 1-2, check power supply rating marked on the name plat on the side of the analyzer. The power supply rating for the analyzer must correspond with power supply available and in accordance with the specifications for the analyzer.

Power supply connection to the right.

Oxygen sensor

The system is arranged with the sensor connection terminal JS-2 pre-wired down to the 5 poles female sensor connection.

Interfaces and I/O's

The system interface and input/output connections are all to be connected to JS3 terminals 1-14.

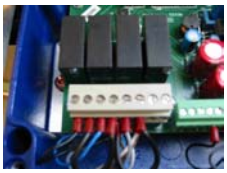
As a standard configuration the following pre-wiring has been arranged:
Connection 5-9 = Internal power supply for opto couplers
Connection 10-14 = Interface span calibration gas OK
Connection 11-14 = Interface zero calibration gas OK
Connection 12-14 = Interface system ON. With open connection and P0200=0 the system will switch to stand by mode with half sensor power.

Interface connections

The following connections will have to be arranged:
Signal output 0/4-20 mA = connection 1-2
Aux. input 1 0/4-20 mA 0 Connection 3-4 (optional)
Aux. input 2 0/4-20 mA 0 Connection 6-8 (optional)
Aux. input 3 0/4-20 mA 0 Connection 7-8 (optional)

Relay outputs

The power board is arranged with four (4) relay outputs connected to JP1 terminals 1-8. Relay 1, 2 and 3 are optionally functions for automatic calibration and relay 4 as a common alarm relay. All relay functions are connected with normal open function


Terminal for relay output

Relay 1 is connected to terminals 1-2 = solenoid valve for Zero gas (low cal.)
Relay 2 is connected to terminals 3-4 = Solenoid valve for Span gas (high cal.)
Relay 3 is connected to terminals 5-6 = Solenoid valve for Sample gas
Relay 4 is connected to terminals 7-8 = Common alarm analyzer

When the monitoring system is arranged for automatic calibration the power supply for the solenoid valves are normally taken after the fuse elements inside the analyzer. The 0.5 AT fuse inside the analyzer can be replace with up to 2.0 A fuse when solenoid valve are powered from the analyzer.

For connection of optional solenoid valves see appendix VI.5

II.3 Commission of system

Before starting the system for the first time after completing the installation check and confirm that all gas and electrical connections are carried out according to instruction and in accordance with good installation practice.

II.3.1 Pre-checks:

- Check that the span and zero calibration gases are connected and that all connections are secured and not leaking. ***A leaking connection will result in loss of calibration gas and may result in poor calibration.***

- Check that the sample gases are connected and that the connections are secured and not leaking. Sample gas connections should be as close to the process as possible and preferably made from 6 mm stainless piping in order to reduce the dead volume in the sampling system. If the sample gas is heavily contaminated pre-filter should be installed. The sample gas has to be taken from a suitable location representing the gas to be tested.

II.3.2 Start of system

- Switch on the power supply. During the heating up of the oxygen-probe the display will indicate an increasing oxygen content and will after 1-2 minutes start to stabilize. After 10 minutes when the sensor temperature has reached its operation temperature the oxygen readings are to be considered stable.

- Fill up the bubble glass with clean water. About ¾ filled or ¼ above the center line marked inside the glass

- With the IG system blower running turn the selector valve to sample port to be selected, 1-3.

- Open the flow control valve slowly until bubbles a noted. Open the flow control valve so much there is a steady stream of bubbles from both the by-pass and sample return pipes, placed inside the bubble glass. The left pipe is for by-passing of sample gas and secure a better flow rate. The right pipe is the return of sample gas from the probe(s). Increased flow indicating by more bubbles from both pipes will reduce the sampling delay time.

- The gas flow passing the probe(s) must be adjusted so that the temperature of the probe will not be affected. Too high velocity will change the probe temperature and consequently the readings.

- Turn the selector valve to test and the calibration selector valve to zero and calibrate the zero gas reduction station to about 0.2 bar and until the flow is about the same as noted for the sample gas by observing the bubble flow.

- Turn the calibration selector valve to span calibration gas and adjust the span gas reduction station to about 0.2 bar and until the flow is about the same as noted for the sample gas by observing the bubble flow.

- Re-calibration, or test of calibration can be performed when the probe temperature has reach normal operating temperature and the indication has stabilized. Normally after 10 minutes after starting the system. Calibration is carried out as described in paragraph III.1.

III Operation

This chapter describes the calibration of the SBS_{3500} system and routine maintenance. After completing the installation and before putting the system into operating the system shall be calibrated using known calibration gas. For the optional 0/4-20 mA Aux. inputs 1-3 the calibration is based on input range and scale required.

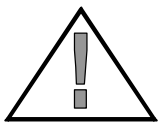
III.1 Calibration Oxygen signal

After switching power on the analyzer readings shall have stabilized, before starting calibration, which normal will take place after about 10 minutes of warm up time.

The analyzer is arranged for manual calibration and optional automatic calibration. In addition the analyzer can be artificial calibration. However, artificial calibration should only be used for quick check and can not replace certified calibration gas.

The zero and span calibration gas is introduced to the analyzer via pressure reduction stations and the selector valve and sampling system via the normal flow direction.

Warning!



The pressure and flow rate of the zero and span gas used to calibrate the analyzer must not exceed 8 bar and flow should be as normally used for sample gas. In order to prevent excessive pressure inside the bubble glass the sample outlet from analyzer and bubble gas must be vented directly to atmosphere.

III.1.2 Manual calibration procedure

The zero calibration gas to be used shall be pure nitrogen with a known amount of oxygen, typically 1-3%.

The certified oxygen content in the zero calibration gas shall be programmed into the analyzer, see program structure or routing diagram function P0405 and change value accordingly.
Note: For artificial calibration the P0405 value shall be 0% oxygen.

Select calibration gas for span or zero calibration

Introduce zero calibration gas to the analyzer by moving selector valve to position test gas and select Zero gas. Check zero calibration pressure on the pressure regulating valve Max. 0.05 MPa

Waite for the zero value reading to stabilize, e.g. 2% oxygen reading and then push the E and ARROW DOWN simultaneously for 5 sec. To save the new zero setting push E again.

The span calibration gas to be used shall be good quality clean dry instrument air with oxygen content of 20.9% is recommended.

Manual calibration of the low value (zero) when zero gas is introduced.

The span oxygen content in the span calibration gas shall be programmed into the analyzer, see program structure or routing diagram function P0406 and change value to 20.9% for normal instrument air.
Note: For artificial calibration the P0406 value shall be 20.9 % oxygen.

Manual calibration of the High value (span) when span gas is introduced.

Introduce the 20.9 % span calibration gas to the analyzer by moving selector valve to position Span Gas. Check Span calibration pressure on the pressure regulating valve, max. 0.05MPa

Waite for the span value reading to stabilize, e.g. 20.9 % oxygen reading and then push the E and ARROW UP simultaneously for 5 sec. To save the new zero setting push E again.

The calibration should be checked weekly or as needed according to the application.

Manual calibration of the High value (span) when span gas is introduced.

III.1.3 Automatic calibration (Optional)

If the analyzer is arranged with the optional possibility to carry our automatic calibration the selector board is equipped with three (3) solenoid valves.

First change P=414 to 0 = use known zero calibration gas e.g. 2% (Save by ENTER)
Next set P0405 to e.g. 2 % and P0406 to 20.9 % (SAVE by ENTER)

Start the calibration in menu P0300 by changing the value to 1 and save.

The calibration will now start with calibrating first LOW and then HIGH. If the calibration takes a long time the it is because the oxygen signal takes too long time to stabilize. The time required for stable signal is set in menu P0415. Default the value is 10 seconds. On the other hand if the stabilizing time is too short the calibration will not be correct as the signal has hot had the required time to stabilize.

If the IGS monitoring system is equipped with two (2) analyzers the calibration will have to take place one at the time. ***Two analyzers cannot be calibrated at the same time***.

During automatic calibration observe the zero and span gas flow is sufficient and bubbles flows from both tubes in the bubble glass.

III.1.4 Artificial calibration

Start the calibration in menu P0300 by changing the value to 1 and save.

The analyzer is arranged with the possibility to carry out an artificial calibration. However, artificial calibration should only be used for quick check and cannot replace manual and automatic calibration with known and certified calibration gasses.

Artificial calibration is carried out as follows:

First change P=414 to 1 = use 0% and air (Save by ENTER)
Next set P0405 to 0% and P0406 to 20.9 % (SAVE by ENTER)

During artificial calibration the sensors have to be exposed to ambient air with an oxygen content of 20.9 % otherwise the calibration will not be correct. Select test and span gas.

Start the calibration in menu P0300 by changing the value to 1 and save.

The calibration will now start with calibrating first LOW and then HIGH. If the calibration takes a long time the it is because the oxygen signal takes too long time to stabilize. The time required for stable signal is set in menu P0415. Default the value is 10 seconds.

III.2 Calibration Optional Aux. Inputs

The analyzer is optional arranged with three (3) 0/4-20 mA auxiliary inputs. The inputs can be configured for most input requirements such as temperature, pressure and load.

The auxiliary inputs are referred to as:

AUX 1 = Analog input 2 (Display: ⊏)
AUX 2 = Analog input 3 (Display: S)
AUX 3 = Analog input 4 (Display: L)
Display range 0.0 to 999.9
The display range, is selected by the Min. and Max. value in sub-menus.

The min. values are set in: P0405, P0505, P0605 and P0705(P0505 & P0506
The max. values are set in: P0406, P0506, P0606 and P0706(P0505 & P0506

The 0-22 mA current analog input signal is in the AD-converter with a 12 bit resolution or 4096 steps.

AUX – 1 (terminal input JS-3 terminals 3 and 4)
The calibration of the input signal AUX 1 is done in steps by connecting a known LO-value current to the input and pressing ENTER in the Zero cal. Menu P0507 to accept the low–end calibration value.

Next connect a known HI-value current on the input, and press ENTER in the span cal. menu P0508 to accept the high-end calibration value.

The Min. /Max.- values at the menu P0505 and P0506 are used for conversion of the raw data into the required scale and range.

AUX – 2 (terminal input JS-3 terminals 5 and 6)
The calibration of the input signal AUX 2 is done in steps by connecting a known LO-value current to the input and pressing ENTER in the Zero cal. Menu P0607 to accept the low–end calibration value.

Next connect a known HI-value current on the input, and press ENTER in the span cal. menu P0608 to accept the high-end calibration value.

The Min. /Max.- values at the menu P0605 and P0606 are used for conversion of the raw data into the required scale and range.

AUX – 3 (input JS-3 terminals 7 and 8)
The calibration of the input signal AUX 3 is done in steps by connecting a known LO-value current to the input and pressing ENTER in the Zero cal. Menu P0707 to accept the low–end calibration value.

Next connect a known HI-value current on the input, and press ENTER in the span cal. menu P0708 to accept the high-end calibration value.

The Min. /Max.- values at the menu P0705 and P0706 are used for conversion of the raw data into the required scale and range.

III.3 Setting of output signal

(Output JS-3 terminals 1 and 2)
The isolated 4-20 mA analogue output signal can be adjusted in program structure P0807 for zero and P0808 for span. The zero value P0807 is normally in the range 150 to 200 and the span value in the range 950to 1000. First the output range, output type and range must be selected in the following steps.

1. Connect a current meter with the range 0 to 20 mA between terminals JS3-1(+) and JS3-2 (-)
2. Set the output range P0801 to 1 = enabling 4-20 mA output signal
3. Set output selection P0802 to 1=oxygen, 2=Aux 1., 3=Aux 2, 4=Aux 3
4. Set Min. value P0805 to 0.0 (Example for oxygen signal output)
5. Set Max. value P0806 to 20.9 (Example for oxygen signal output)

Apply zero calibration gas e.g. 2% oxygen content to the analyser at the correct pressure and flow rate. When the readings has stabilised adjust the zero value P0807 for 5 mA output signal based 2 % oxygen level, see signal charge under appendix.

Then apply span calibration gas in the form of clean instrument air (20.9%) to the analyser at the correct pressure and flow rate. When the readings has stabilised adjust the span value P0808 for 20 mA output signal.

For further references see appendix **Error! Reference source not found.** and Program structure

III.4 Setting of output range

The isolated 4-20 mA analogue output signal can be ranged in program structure P0805 for Min. value and P0806 for Max. value. The range is pre-set P0805 for Min. value = 0 and P0806 for Max. value = 20.9.

The range can be changed in both the Min. and Max. area. Normally only the Max. setting is changed.

The output signal shall correspond to external requirements for input signal and range.

For further references see appendix VI , program structure.

III.5 Setting of alarm limits

The analyzer is arranged with a common alarm output relay (DO-4).
The alarm can be enabled for the oxygen signal and the three (3) aux. Inputs, see menu structure. Further the probe service module is arranged with alarm functions.

When one of the alarms are energized the display will indicate the alarm e.g. high Oxygen content P0404. When pressing the enter key the oxygen content will be displayed.

The Alarm values are set by first entering the MENU and the entering the submenu where the alarm values are to changed e.g. P0404 high oxygen level.

By using the ARROW-UP ad ARROW-DOWN the alarm setting is changed.
After changing the alarm value to the required level return to upper level by pressing ENTER and then MENU. On return you will be asked to save the new setting. If you want to save the setting press Enter to confirm the new settings.

Before shipment the analyzer alarm was set as per standard default values, see menu configuration sheet.

III.6 Routine Maintenance

III.6.1 Sample and test selection

The system with the selector valve's, and optional solenoid valves is tested from factory. For the selector valve packing adjustment may be required for leak-tight performance. ***Warning: Failure to periodically inspect and maintain valve packing may lead to product malfunction***. Adjusting the packing by turning the packing bolt clockwise in 1/16-turn increments until leak-tight performance is achieved. Always verify proper operation upon installation.

Periodical check the reduction stations and connection for leaks. Max. allowed pressure for the reduction stations is 8 Bar and temperature 60 °C. Depressurize the reduction stations before cleaning and service. Clean with neutral detergent. Prevent the reduction units from the ultraviolet rays and adhesion of organic solvents.

III.6.2 Bubble glass and flow control

The system with flow control valve, filter, bubble glass and sensor is tested from factory. The filter element located on top of the bubble glass will require periodical replacement. The period between changes to be determent based on actual sample condition and how dirty the filter gets. When changing the filter the sample flow control valve must be closed or system completely isolated from the sample or calibration gas while the filter element is being changed. The filter element is removed by unscrewing the filter top using 6 mm allen-key. Check the condition of the O-ring seals and replace if required, see spare part list.

It is recommend to drain the bubble glass monthly and re-fill with clean distilled water.
The bubble glass may need internal cleaning and O-rings replaces as required for leak free operation. Clean with neutral detergent. Prevent the glass from ultraviolet rays and adhesion of organic solvents. For spare parts see spare part list.
Check daily the level in the bubble glass and re-fill with clean distilled water as required.

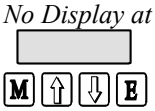
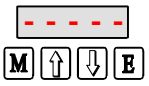
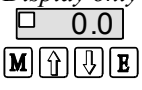
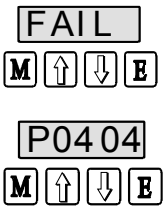
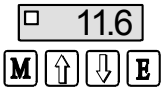
III.6.3 Analyzer

The Analyzer is tested from factory.
The analyzer does not require any special maintenance. Dirt and oil on the surface of the analyzer (s) to be removed carefully using neutral detergent and clean dry rag.

For calibration and change of settings see above and appendix VI, settings and quick Guide-calibration.

IVTrouble-shooting:

Trouble-shooting should always be carried out by trained and certified personnel. The SBS_{3500} Oxygen Monitoring System is connected to hazardous electric voltages, which can cause severe personal injury or mechanical damage if not handled correctly and in accordance with normal safety regulations.

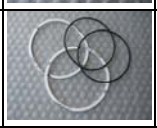
Trouble:	*Possible cause:*
No Display at all – Black: 	*No power supply* *Fuse has blown inside the analyzer 0.5 AT* *Check power supply is the power supply correct voltage*
Display only indicating dotted line: 	*The interface signal terminal JS-3 terminal 12-14 is open and the analyzer is configured for st.-by mode, see P0200. (0=st-by mode - 1=ON all the time)* *Close terminal 12-14 or change st-by mode to ON all the time in program P0200 and save*
Display only indication 0.0 	*No signal from probe. Check probe connection both at the analyzer and probe end.* *Bad probe. Change the probe with spare probe.* *Bad connection: Repair or change connection cable*
Flicking FAIL and then a program no. e.g P0404 	*Fail means failure or alarm. The FAIL follows by a program no. indicating the alarms.* *P0403 = Alarm low oxygen* *P0404 = Alarm high oxygen* *P0503 = Alarm low Aux.1 signal (P0603 and P0703)* *P0504 = Alarm high Aux 1 signal (P0604 and P0704)* *Alarms for low cal. and Runtime see P9803, P9804 & P9805* *Alarms disable = P0402-P0502- P0602- P0702=0* *Alarms enable = P0402-P0502- P0602- P0702=1* *Alarm automatic reset = P0100 = 1* *Alarm manual reset = P0100 = 0 (ENTER for reset)*
Incorrect indication of Oxygen level. 	*The calibration may have been incorrect applied. Check calibration and go back to workable range. Re-calibrate the analyzer, see III.1* *If normal manual calibration is not working try artificial calibration first. See III.1*

Incorrect remote display and recording	*Check display range setting P0805 and P0806* *Check and re-calibrate the output signal, see chapter III.3*
Incorrect signal output, resulting in wrong display of oxygen level on remote instrumentation.	*Overloading of the output signal. The analyzer can power up to 200 ohm load without using signal repeater or signal amplifier.*

Extended trouble:	*Possible cause:*
No display despite power supply and fuse is found OK	*The analyzer is defect.* *The analyzer*
Can not calibrate the analyzer despite calibration procedure is followed correctly	*The oxygen cell may be may out of order* *The sensor cable is damaged* *The analyzer is defect*

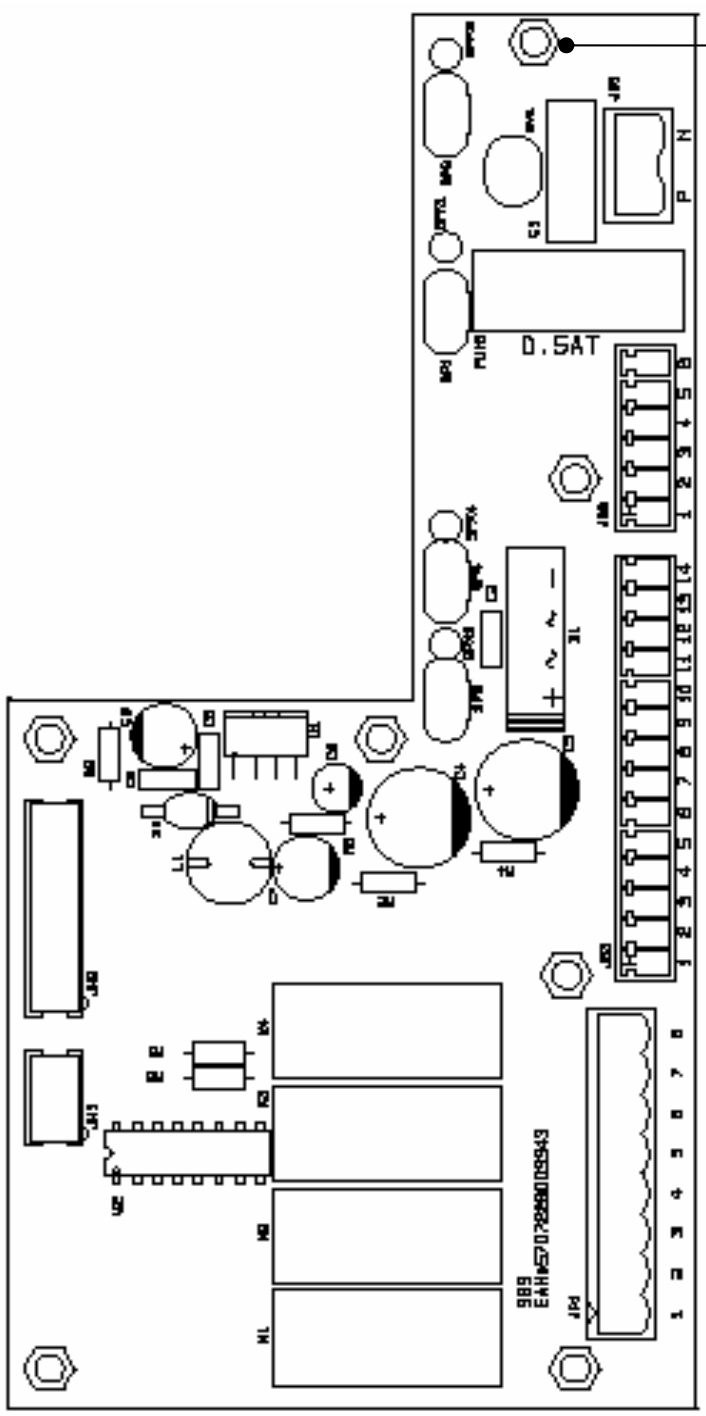
V Spare Part list

Item #:	Part ID	Part Description	Picture	Parts incl.
1	00328	O-ring for IG-sensor		
2	00331	Bubble glass complete		
3	00354	Finger nut, stainless st.		
4	00358	Selector valve sample/test gases		
5	00373	O-ring set filter house		
6	00379	Bubble glass tube		
7	00380	Sample filter glass		
8	00390	Sensor complete with O-ring/disc.		
9	00395	Spare filter set (5pcs.)		
10	00403	Span gas filter regulator		

11	00404	Zero gas regulator		
12	00407	Cover plate – sensor SS		
13	00477	Sensor cable complete		
14	00493	Fuse for analyzer 0.5AT		
15	00605	Gasket for drain plug		
16	00754	Gasket set bubble glass		
17	00728	Oxygen analyzer 220VAC-HA		
18	00739	Selector valve test gases		
19	00745	Flow control valve, 1/8”		
20	00749	Oxygen analyzer 110 VAC-HA		
21	00753	Quick Guide-Calibration		
22	00755	Installation Manual		
23	00756	Installation & Operating instruction		
		Optional equipment		
24	00592	Signal converter (4-20 mA)		

VIAppendix

VI.1 Hookup Information Power Board



Protective earth	Spade
Neutral Live	N
Power lead	P

U-sensor 5 (Gray) GY	JS-2 terminal 6
U+ sensor 4 (Black) BK	JS-2 terminal 5
Ground (Non)	JS-2 terminal 4
UN – Sensor 3 (Blue) BU	JS-2 terminal 3
REF–Sensor 2 (White) WH	JS-2 terminal 2
IPE– Sensor 1 (Brown) BN	JS-2 terminal 1

Start Calibration (closed)	JS-3 terminal 14
Calibration start	JS-3 terminal 13
IGS running (closed)	JS-3 terminal 14
IGS running signal	JS-3 terminal 12
Calibration gas zero OK (closed)	JS-3 terminal 14 JS-3 terminal 11
Calibration gas span OK (closed)	JS-3 terminal 14 JS-3 terminal 10
opto-coubler power supply	JS-3 terminal 9
Common 12 V sup-ply to	JS-3 terminal 5
Common AGND (-)	JS-3 terminal 8
AUX 3 0-22 mA (+)	JS-3 terminal 7
Common AGND (-)	JS-3 terminal 8
AUX 2 0-22 mA (+)	JS-3 terminal 6
Common AGND (-)	JS-3 terminal 4
AUX 1 sensor (+)	JS-3 terminal 3
Common AGND (-)	JS-3 terminal 2
0/4-20 mA (+) Output	JS-3 terminal 1

Alarm common (R-4)	JP-1 terminal 8
Closed during alarm	JP-1 terminal 7
Sample Valve (R-3)	JP-1 terminal 6
Closed during calibration	JP-1 terminal 5
Span calibration (R-2)	JP-1 terminal 4
Open during span cal.	JP-1 terminal 3
Zero Calibration (R-1)	JP-1 terminal 2
Open during zero cal.	JP-1 terminal 1

VI.2 Program structure

With reference to the Routing Diagram **Error! Reference source not found.** the various menu-selections are done by using four keys:

1. **MENU:**
2. **ENTER:**
3. **ARROW-UP:**
4. **ARROW-DOWN:**

Use the **ARROW-UP** or **ARROW-DOWN** to switch between the various sensor input i.e. % Oxygen, Temperature, AuxIP1 and AuxIP2.

In case of remote displays a minimum menu is used i.e. no menus for input and output.

The menu is entered by pressing **MENU**.
Use the **ARROW-UP** or **ARROW-DOWN** to switch between the submenus.
When the correct menu-item has been found, press **ENTER** to enter the menu-parameter.
The display will now show the parameter that is to be checked or changed.

Press **MENU** to leave the parameter unchanged, going to the last menu-item.
Use the **ARROW-UP** or **ARROW-DOWN** to change the displayed parameter.
When the parameters are OK, press **ENTER** to temporarily save the new value and exit the menu-item.

Use the **ARROW-UP** or **ARROW-DOWN** to switch between the submenus
or press **MENU** to go to the top level.
On returning to the top-level you will be asked to **SAVE** settings.
Use the **MENU**, **ARROW-UP** or **ARROW-DOWN** for NO and **ENTER** for YES.

Each menu has a unique number starting with "P" i.e. P0001, P0002., see Routing Diagram.

When the system is in standby or not active the display will show "-----"
but pressing any of the four keys will enable access to the menu.

A five minutes timeout for "no action"/ "no changes" will exit the menu.
In case the menu has been entered and left open, a one minute timeout will automatically close the menu, discarding any changes.

System Menu continued...

Menus marked with an " R" in front are Restricted and only access able if P9902=1

Menus marked with an " D" in front are always Displayed, but have write-access if P9902=1

Menus with " module disable" will not show the lower-levels of the menu for that module.

No's. in italic are default data.

|_ P0100, Alarm Reset			
Note	***Default***	**Menu**	**Functions**
	1	|_ P0100	1 = Automatic alarm reset - 0 = manual alarm by reset

|_ P0200, Device ON/OFF Stand-By-Mode (sensor saving)			
Note	***Default***	**Menu**	**Functions**
	0	|_ P0200	1=ON - 0=OFF (display " -----") External signal (D1-3 run) overrides OFF to ON

|_ P0300, Calibration			
Note	***Default***	**Menu**	**Functions**
	0	|_ P0300	1=start, 0 =stop, (1 = for start of calibration)

|_ P0400, Oxygen Input			
Note	***Default***	**Menu**	**Functions**
	1	|_ P0401	1 = Oxygen signal enable - 0 = Oxygen signal disable
	0	|_ P0402	1= Alarm P0403 and P0404 enable - 0 = disable
	0.0 %	|_ P0403	Alarm LO in % Oxygen
	22 %	|_ P0404	Alarm HI in % Oxygen
	1 %	|_ P0405	Min value in % Oxygen (for calibration see below note)
	20.9 %	|_ P0406	Max value in % Oxygen (for calibration)
R	*1230- cal*	|_ P0407	Zero cal, 0-4095 from auto calibration
R	*3600- cal*	|_ P0408	Span cal, 0-4095 from auto calibration
	10 s	|_ P0409	Delay for Auto-alarm On/Off, 0-120 seconds ref. P0100
	0	|_P0410	1 = Multiple probe enable. The master scans the network for other masters (address. 2-9)
	2 %	|_ P0411	Max variation between master oxygen probes in % oxygen
D	*0*	|_ P0412	NOT implemented
D	*22*	|_ P0413	NOT implemented
	0	|_ P0414	1 = use ambient AIR (see artificial cal. III.1.4) 0 = use known gasses e.g. 2%
	10	|_ P0415	Time in seconds for stable calibration signal (only with auto. Cal.)

|_ P0500, (AUX.:1) - e.g. IG-Temperature input			
Note	***Default***	**Menu**	**Functions**
	1	|_ P0501	1 = Aux. 1 signal enable - 0 = Aux. 2 signal disable
	0	|_ P0502	1= Alarm P0503 and P0504 enable - 0 = disable
	0	|_ P0503	Alarm LO in °C
	999	|_ P0504	Alarm HI in °C
	0	|_ P0505	Min value in display units
	999	|_ P0506	Max value in display units
R	*0*	|_ P0507	Zero cal, 0-4095 from manual calibration, press enter to accept
R	*4095*	|_ P0508	Span cal, 0-4095 from manual calibration, press enter to accept
	0 s	|_ P0509	Delay for Auto-alarm On/Off, 0-120 seconds ref. P0100

|_ P0600, (AUX.:2) - e.g. IG-Pressure			
Note	***Default***	**Menu**	**Functions**
	1	|_ P0601	1 = Aux. 2 signal enable - 0 = Aux. 2 signal disable
	0	|_ P0602	1= Alarm P0603 and P0604 enable - 0 = disable
	0	|_ P0603	Alarm LO in °C
	999	|_ P0604	Alarm HI in °C
	0	|_ P0605	Min value in display units
	999	|_ P0606	Max value in display units
R	*0*	|_ P0607	Zero cal, 0-4095 from manual calibration, press enter to accept
R	*4095*	|_ P0608	Span cal, 0-4095 from manual calibration, press enter to accept
	0	|_ P0609	Delay for Auto-alarm On/Off, 0-120 seconds ref. P0100

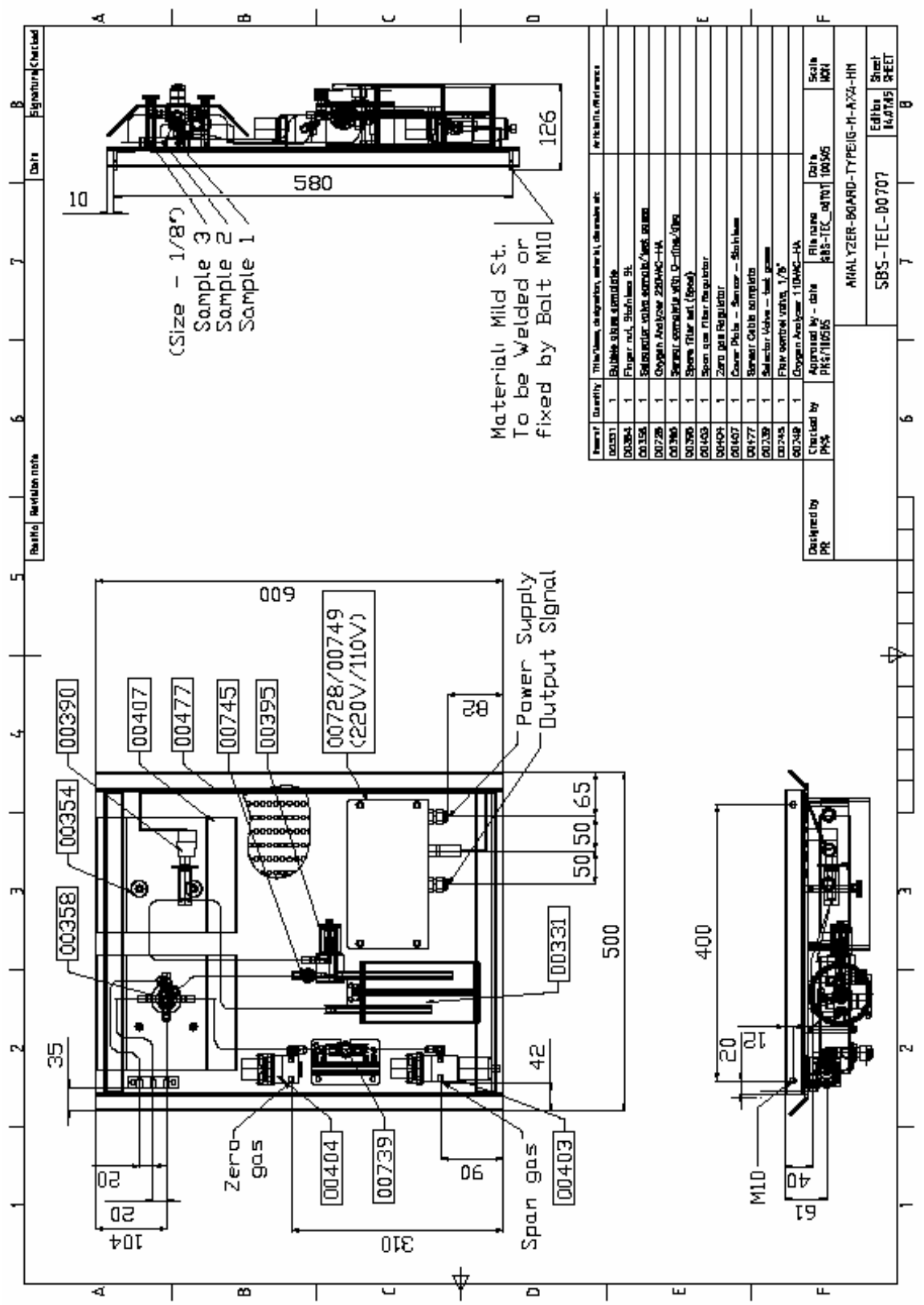
|_ P0700, (AUX.:3) - e.g. Protection			
Note	***Default***	**Menu**	**Functions**
	1	|_ P0701	1 = Aux. 3 signal enable - 0 = Aux. 3 signal disable
	0	|_ P0702	1= Alarm P0703 and P0704 enable - 0 = disable
	0	|_ P0703	Alarm LO in °C
	999	|_ P0704	Alarm HI in °C
	0	|_ P0705	Min value in display units
	999	|_ P0706	Max value in display units
R	*0*	|_ P0707	Zero cal, 0-4095 from manual calibration, press enter to accept
R	*4095*	|_ P0708	Span cal, 0-4095 from manual calibration, press enter to accept
	0	|_ P0709	Delay for Auto-alarm On/Off, 0-120 seconds ref. P0100

|_ P0800, 0/4-20 mA output signal			
Note	***Default***	**Menu**	**Functions**
	0	|_ P0801	1 = 0/4-20 mA signal enable - 0 = 0/4-20 mA signal disable
	1	|_ P0802	Output selection 1= Oxygen - 2= Aux. 1 - 3 =Aux. 2 – 4=Aux 4
	15	|_ P0803	Release delay of freezing of output signal during aut. cal.
	0	|_ P0805	Min value in display units
	25	|_ P0806	Max value in display units
R	*0*	|_ P0807	Zero cal, 0-4095 from manual calibration, press enter to accept
R	*1023*	|_ P0808	Span cal, 0-4095 from manual calibration, press enter to accept

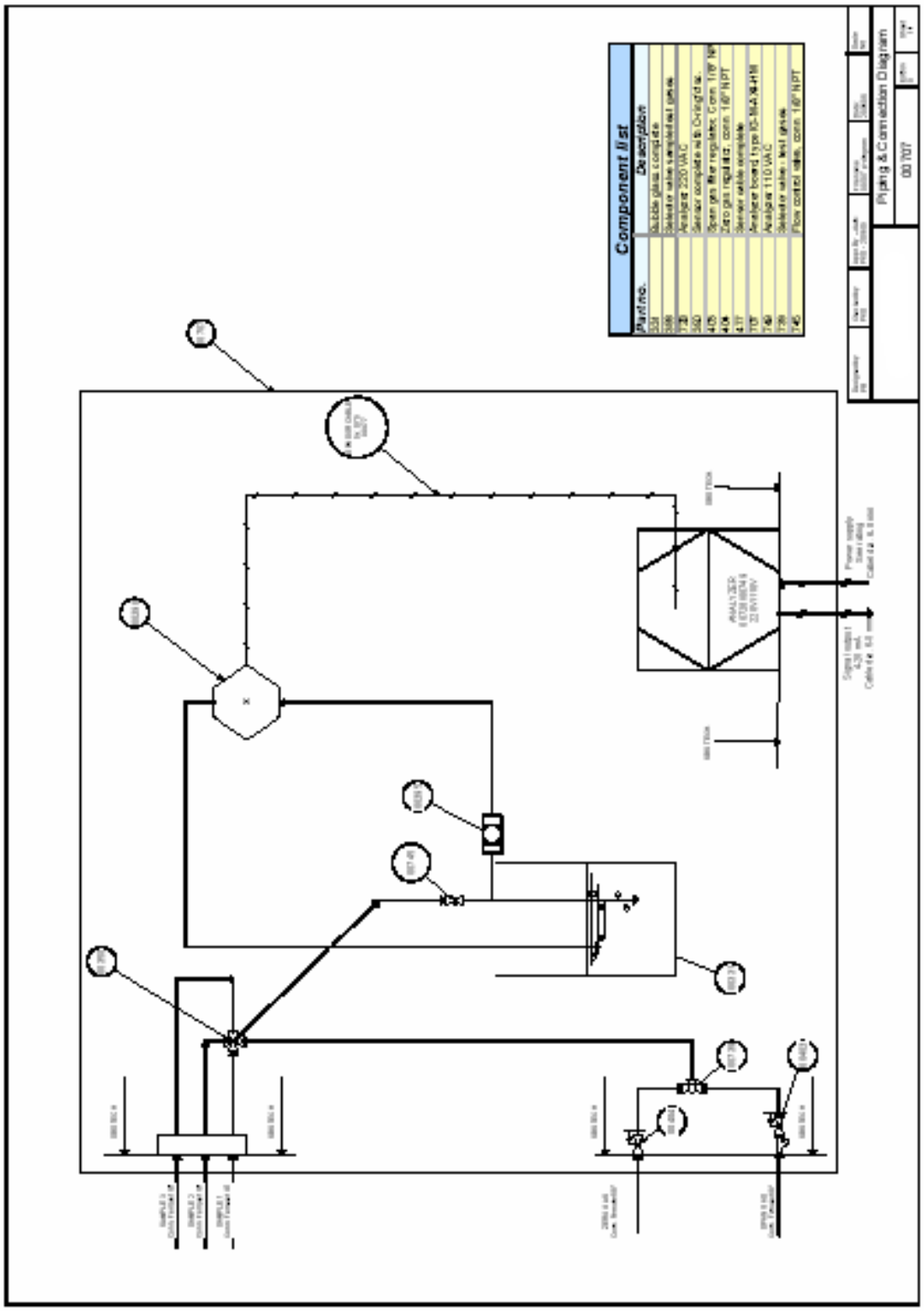
|_ P9800, Probe service, Password protected "8651"			
Note	***Default***	**Menu**	**Functions**
	0	|_ P9801	1=Probe service module enable - 0=Probe service module disable
	0	|_ P9802	1=Alarm P9803, P9804 & P9805 enable - 0=Alarm disable
	0	|_ P9803	Alarm LO for oxygen cal. zero
	4095	|_ P9804	Alarm HI for oxygen cal. span
R	*10000*	|_ P9805	Alarm Runtime in hours 0-65535
D	*0*	|_ P9806	Runtime in hours 0-65535, full-ON as full time, half ON as half time
R	*0*	|_ P9807	First cal. Zero value for memory
R	*4095*	|_ P9808	First cal. Span value for memory
R	*24*	|_ P9809	Time between self cal in hors 0-65535 – 0=self cal. OFF
R	*0*	|_ P9810	1= New probe mounted, clear old probe data – cleared after new cal.
R	*0*	|_ P9811	1= Probe half power when Interface is OFF - 0=Full power

|_ P9900, Device type service, Password protected "1166"			
Note	***Default***	**Menu**	**Functions**
	0	|_ P9901	0=Remote Display, 1= Master, 2-9 = secondary master, 10 = PC 11= Instrument, 12-255 reserved
	0	|_ P9902	1=Restricted menus enable - 0 = Restricted menus disable
	0	|_ P9903	Binary disable menus enable, 0= restricted menus disable
	0	|_ P9904	1= Upload of parameters from PC, Clear after use
	0	|_ P9905	1 = Single test transmission of all parameters to PC - 0 = Off
	5	|_ P9906	No. of samples for mean-value per input, 0-65535
R	*10000*	|_ P9909	1 = Complete data erasure

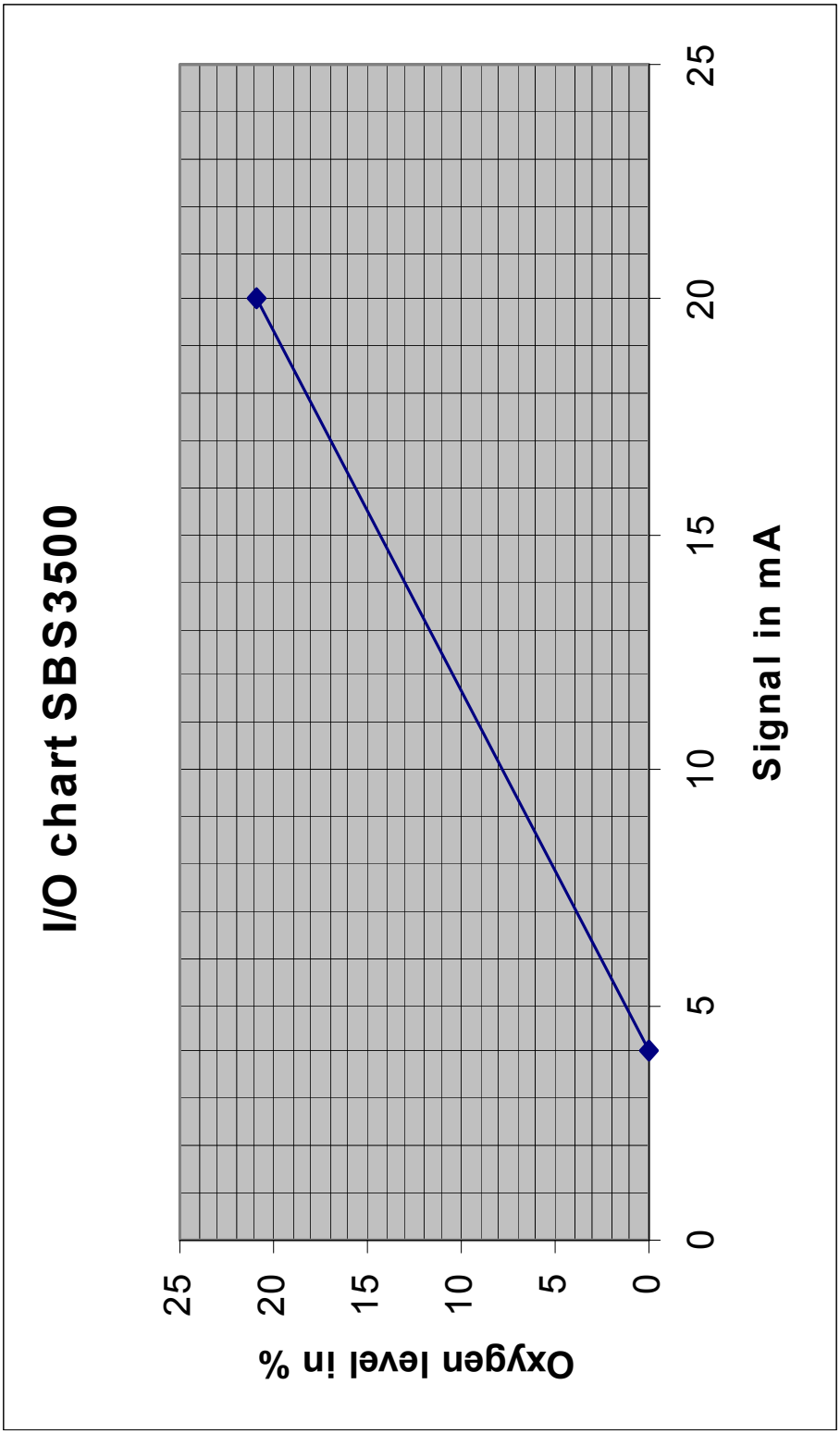
VI.3 Oxygen Analyzer Board



VI.4 Piping & Connection Diagram



VI.5 Output signal charge



VI.6 Quick Guide -Calibration

Manual Calibration

Manual calibration low (zero)

1. Menu P0405 to be set according to low calibration gas used
2. Turn selector valve to Test gas and select zero gas
3. Check and adjust flow if required – bubbles from both pipes
4. With value steady push E and ↓ simultaneously for 5 sec.
5. Cal. L will appear after which the new low setting can be saved

Test Gas+Zero

Stabilized reading

Calibration

Save new setting

Manual calibration high (Span)

6. Menu P0406 to be set according to high calibration gas used
7. Turn selector valve to Test gas and select span gas
8. Check and adjust flow if required – bubbles from both pipes
9. With value steady push E and ↑ simultaneously for 5 sec.
10. Cal. H will appear after which the new high setting can be saved

Test Gas+Span

Stabilized reading

Calibration

Save new setting

NOTE:
During operation and calibration observe flow and adjust if required
Saving of the new setting by pushing "E"

Artificial calibration

Artificial calibration

11. *Menu P0405 to be set at 0%*
12. *Menu P0406 to be set at 20.9% (ambient air)*
13. *Menu P0414 to be set at 1 = use ambient air*
14. Turn selector valve to Test gas and select span gas
15. Check and adjust flow if required – bubbles from both pipes
16. Start Calibration in menu P0300 by entering "1"
17. After changing menu P0300 value to 1 then save by pushing E
18. The artificial calibration will now be carried out automatically

Test Gas+Span

Check menu P0405/P0406

Enter menu 300

Start Cal. (#:1)

Check bubbles

Cal. Completed

NOTE:
During artificial calibration senor to be exposed to ambient air (Span gas)
During operation and calibration observe flow and adjust if required

Contact Hamworthy Moss AS for information's about Inert Gas Analyzers & Monitoring Systems

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CERTIFICATES AND TEST SHEETS

MOSS INERT GAS SYSTEM FOR:
DUNQUAT SHIPYARD
HULL NO.: H-8239
HAMWORTHY MOSS AS PROJ. NO.: P. 4398
HAMWORTHY MOSS AS ORDER NO.: 130959

TABLE OF CONTENT

NO.	DESCRIPTION
1	Approval letter sent from DNV
2	Test Report of IGG (Burner/Scrubber Unit), Deck Water Seal & P/V-Breaker
3	Test Report for Control and Monitoring Systems
4	Inspection certificate of Centrifugal Air Blowers

Electronically published by ABS London. Reference 223274, dated 26-MAR-2007.

ABS EUROPE LIMITED

Hamworthy Moss AS
P.O.Box 1053
NO-1510 Moss
Norway

Reference: DO/AP/MA/223274 & 223301
Project Number: 1687508
Class Number: YY143061

Attention: Mr. Espen Thorvaldsen

Dungquat Shipyard Hull No.8239
Hamworthy Moss AS Project No.: P.4398
Flue Gas System with Topping up Generator
Drawings as per attached list,

Gentlemen,

We have your letter of 31st January 2007 (Your ref. 130959/ET) on the above subject, submitting four (4) copies of the subject drawings and with thereto have to advise that provided the details and arrangements be adhered to, the work is to the satisfaction of the Surveyor and the Rules in all other aspects are complied with, the same will be approved in association with the attached comments.

Please find enclosed our invoice to cover the cost of the subject review.

Two (2) copies of the subject drawings, stamped to indicate our review, are being returned.

Very truly yours

By: J.L.M

J. L. Morgan
Principal Engineer
Ship Engineering Department

cc: ABS Ho Chi Minh/P
ABS Oslo/P

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ABS EUROPE LIMITED

Drawing List

Engineering Office:	London Engineering Department	
Submitter:	HAMWORTHY KSE MOSS AS	
Drawing No	**Revision No**	**Drawing Title**
130959-00	0	SPECIFICATION FOR MOSS FLUE GAS SYSTEM
130959-01	0	SPECIFICATION FOR MOSS TOPPING UP GENERATOR
130959	0	PART LIST
M1300-007STD	00	MOSS SYMBOL TABLE SUPPLY EQUIPMENT
130959-100-01	00	P&I DIAGRAM I
130959-101-01	00	P&I DIAGRAM II
130959-051-01	00	SCRUBBER UNIT ARRANGEMENT
130959-050-01	00	BURNER SCRUBBER UNIT ARRANGEMENT
130959-052-01	00	DECK WATER SEAL
130959-053-01	00	PRESSURE VACUUM BREAKER
ELECRTICAL DIAGRAMS	00	ELECTRICAL DIAGRAMS

Electronically published by ABS London. Reference 223274, dated 26-MAR-2007.

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Comments List

Thread No	Comment Text	Facilities	Action
P-280	130959-00 - SPECIFICATION FOR MOSS FLUE GAS SYSTEM	8239[Open]	Surveyor
	Adequate water supply to the deck water seal is to be provided by at least two separate pumps, as per 5-1-7/25.19.3 of the Rules. Attending Surveyor to verify.		
P-281	130959-00 - SPECIFICATION FOR MOSS FLUE GAS SYSTEM	8239[Open]	Surveyor
	We understand that the following items may not part of your scope of supply. Accordingly, by copy of this letter, we request our attending Surveyor to advise the Shipyard to demonstrate and/or to submit the appropriate drawings and documentation to the local ABS technical office in order to verify compliance with the following items: 1) Details of the inert gas supply piping to the cargo tanks and the venting, purging and gas freeing arrangements etc. are to be in compliance with the applicable requirements. Details in this regard are to be submitted to the local ABS technical office for review. 2) The cooling water pumps for the flue gas scrubber are to be certified by an ABS Surveyor at the manufacturer's plant, as per 4-6-1/7.3.1 (vii) of the Rules.		
P-282	130959-00 - SPECIFICATION FOR MOSS FLUE GAS SYSTEM	8239[Open]	Surveyor
	Fuel oil pump for topping up generator is to be certified as per 4-6-4/13.7.3 of the Rules. Attending Surveyor to verify.		
P-283	130959-00 - SPECIFICATION FOR MOSS FLUE GAS SYSTEM	8239[Open]	Surveyor
	Portable instruments to detect oxygen and vapor concentration in the inerted atmosphere are to be provided on board, in accordance with 5-1-7/25.33 of the Rules. Attending surveyor to verify.		
E-153	130959ELECTRICAL DIAGRAMS	8239[Open]	Technical
	Audible and visual alarms are to be provided at naviagtion bridge and machinery space to indicate low water level in the water seal unit, in accordance with SV Rules 5C-1-7/25.37.7, FSS Code Chapter 15/2.4.3.1.7. Your clarification is requested.		

Hamworthy

QUALITY CONTROL
LEAKAGE TEST REPORT
(AFTER SURFACE TREATMENT)

Drwg. No. 13.957-05-1-01
Contract No. 13095-9.
Date: 4.9.07
Procedure No.QP09part1

Subject: **Scrubber Unit / ~~Deck Water Seal~~**			
Design Pressure	Bar	Requested Test Pressure 0.25	Bar
Test gauge No. 10"		Range:	
Test medium: air and soapy water			

DURATION OF TEST

From data 4.9.07 Time 10:30 Temperature 29°C Pressure 0.25 bar

To data 4.9.07 Time 11:30 Temperature 29°C Pressure 0.25 bar

REMARKS

UNIT HAS BEEN LEAKAGE TESTED AND NO LEAKAGE WAS DETECTED.

Hamworthy Suzhou	Sub.contr.	Client
Roger		

Hamworthy
FLUID INNOVATION

QUALITY CONTROL
SPARK TEST

Drwg. No. 130959-051-01
Contract No. 130959
Date: Aug. 20. 07

Subject:
SCR

Testing Equipment:

Elcometer 236

Extent of control: 100% OF LINING TESTED WITH 1500 VOLTS

Results: 1 point on plate.

Repaired. . ok.

Remarks: LINING THICKNESS MEASURE FROM 818 TO 1235

SUBJECT/SUBJECTS APPROVAL ACCORING TO DRAWINGS AND SPECIFICATION.

Hamworthy Suzhou	Sub.contr.
[signature] 07.8.20	

Hamworthy

QUALITY CONTROL
LEAKAGE TEST REPORT
(AFTER SURFACE TREATMENT)

Drwg. No. 13052-52-01
Contract No. 13-959
Date: 29.8.07
Procedure No.QP09part1

Subject: **Scrubber Unit / Deck Water Seal**			
Design Pressure	0.3 Bar	Requested Test Pressure	0.45 Bar
Test gauge No.	V	Range:	—
Test medium: air and soapy water			

DURATION OF TEST

From data 29.8.07 Time 13:00 Temperature 28°C Pressure 0.45 bar

To data 29.8.07 Time 14:00 Temperature 28°C Pressure 0.45 bar

REMARKS

UNIT HAS BEEN LEAKAGE TESTED AND NO LEAKAGE WAS DETECTED.

Hamworthy Suzhou	Sub.contr.	Client

Hamworthy
FLUID INNOVATION

QUALITY CONTROL
SPARK TEST

Drwg. No:130959-052-01
Contract No:130959
Date:2007.08.27

Subject:
D W S

Testing Equipment:

Elcometer 236

Extent of control: 100% OF LINING TESTED WITH 1500 VOLTS

ok

Results:

Remarks: LINING THICKNESS MEASURE FROM 1024 TO 1536

SUBJECT/SUBJECTS APPROVAL ACCORING TO DRAWINGS AND SPECIFICATION.

Hamworthy Suzhou	Sub.contr.
08/28/07	

Hamworthy

QUALITY CONTROL
LEAKAGE TEST REPORT
(AFTER ASSEMBLY)

Drwg. No. 13097
Contract No. 13097-050-01
Date: 28.8.07
Procedure No.QP09part1

Subject: ~~IGG~~ TGB			
Design Pressure	0.7 Bar	Requested Test Pressure	0.85 Bar
Test gauge No.	"U"	Range:	
Test medium: air and soapy water			

DURATION OF TEST

From data	28.8.07	Time	13:40	Temperature	28°C	Pressure	0.43 bar
To data	28.8.07	Time	14:40	Temperature	25°C	Pressure	0.45 bar

REMARKS

UNIT HAS BEEN LEAKAGE TESTED AND NO LEAKAGE WAS DETECTED.

Hamworthy Suzhou	Sub.contr.	Client
30.8.07		

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS CONTROL PANEL FAT AND CLASSIFICATION DOCUMENT.

HAMWORTHY SYSTEM NAME:	FLUE GAS SYSTEM WITH TOPPING UP GENERATOR			
HAMWORTHY ORDER NO.:	130959			
HAMWORTHY SERIAL NO.:	6294			
SHIP NAME/HN:	HULL B/8239 PILS (SHI) Dunquat SY/Vinashin			
CAPACITY:	9400 m3			
HAMWORTHY PROGRAM NAME AND REVISION:	NAME: 130959			
	REVISION: NO REVISION			
E2PROM SERIAL NO.:	PLC 1: 2107/200627			
CPU SERIAL NO.:	PLC 1: 2107 2600 178	PV: 12	RL: 12	SV: 2.31
PLC SOFTWARE VERSION:	PLC 1: UNITY PRO L V. 2.3			
E2PROM SERIAL NO.:	PLC 2: NA			
CPU SERIAL NO.:	PLC 2:NA	PV:	RL:	SV:
PLC SOFTWARE VERSION:	PLC 2:NA			
OPERATOR PANEL TYPE AND SOFTWARE VERSION MCP:	TYPE: MAGELIS XBTGT 5330			
	VERSION: VIJEO DESIGNER V. 4.5.1			
OPERATOR PANEL TYPE AND SOFTWARE VERSION TUG:	TYPE: MAGELIS XBTGT 2330			
	VERSION: VIJEO DESIGNER V. 4.5.1			
OPERATOR PANEL TYPE AND SOFTWARE VERSION ECR:	TYPE: NA			
	VERSION: NA			
OPERATOR PANEL TYPE AND SOFTWARE VERSION WH:	TYPE: NA			
	VERSION: NA			
TEST PREFORMED BY:	LARS OLAV NILSEN Lars O. Nilsen			
TEST DATE:				
CLASSIFICATION SOCIETY:	ABS			
CLASSIFICATION APPR. NO.:				
SURVEYOR NAME:				
CLASSIFICATION DATE:				

CLASSIFICATION SOCIETY APPROVAL SIGN.

NA

DATE: 19.09.07
SIGN:

Hamworthy

FLUID INNOVATION

TEST/CLASSIFICATION COMMENTS

TEST DOC. APPROVAL NO.:
REF. TO HAMWORTHY P. NO.: 7-3.15

DATE: 19.09.07
SIGN:

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS FLUE GAS SYSTEM

FAT - SIMULATED RUNNING TEST

ITEM	DESCRIPTION	COMMENT	CHE-CKED
MCP	Start Flue gas system	From MCP	Ok
MCP	Stop Flue gas system	From MCP	Ok
MCP	Start air vent system	From MCP	Ok
MCP	Stop air vent system	From MCP	Ok
MCP	Start/stop sea water system	From MCP. Only in air vent. mode	
MCP	Select topping up generator mode	From MCP	Ok
MCP	Start topping up generator auto	From MCP	Ok
MCP	Stop topping up generator auto	From MCP	Ok
MCP	Start topping up generator manual	From MCP	Ok
MCP	Stop topping up generator manual	From MCP	Ok
MCP	Start topping up generator manual	From MCP manual mode	Ok
MCP	Stop topping up generator manual	From MCP manual mode	Ok
MCP	Select valve clean	From MCP	OK
MCP	Select consumer/deck	From MCP	OK
MCP/ TUG	Select topping up generator control	From MCP/TUG	Ok
TUG	Manual start/stop topping up generator	From TUG	Ok
TUG	Stop topping up generator	From TUG	Ok
TUG	Select consumer/deck	From TUG	OK
	Power request / accept function		Ok
	Recorder programmed and tested		Ok
	E2PROM installed		Ok
	Program info. page MCP updated.		Ok

DATE: 19.09.07
SIGN:

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS FLUE GAS SYSTEM

FAT - ALARM AND SHUT DOWN TEST

ITEM NO	DESCRIPTION	SAFETY ACTION	COMMENT	CHE-CKED
h 1	Position Error Valve 1	Flue gas	S.W. cooling down	OK
h 2	Position Error Valve 2	Flue gas	S.W. cooling down	OK
h 4	Position Error Valve 4	Flue gas	S.W. cooling down	OK
h 5	Position Error Valve 5	Flue gas	S.W. cooling down	OK
h 7	Position Error Valve 7	Flue gas	S.W. cooling down	OK
h 8	Position Error Valve 8	Flue gas	S.W. cooling down	OK
h 10	Position Error Valve 10	Flue gas	S.W. cooling down	OK
h 11	Position Error Valve 11	Flue gas	S.W. cooling down	OK
h 14-F	Position Error Valve 14FG	Flue gas	Stop all	OK
h 24-1	Position Error Valve 24-1	Flue gas	S.W. cooling down	OK
h 24-2	Position Error Valve 24-2	Flue gas	S.W. cooling down	OK
	Boiler 1 Soot Blowing Alarm	Flue gas	S.W. cooling down	OK
	Boiler 2 Soot Blowing Alarm	Flue gas	S.W. cooling down	OK
h 26	Position Error Valve 26	Flue gas	S.W. cooling down	OK
IAl 103	Blower 1 Low Load FG	Flue gas	S.W. cooling down	OK
IAl 104	Blower 2 Low Load FG	Flue gas	S.W. cooling down	OK
h 103	Blower 1 Running Alarm FG	Flue gas	S.W. cooling down	OK
h 104	Blower 2 Running Alarm FG	Flue gas	S.W. cooling down	OK
Tah 192	Gas inside scrubber temp. high	Flue gas	S.W. cooling down	OK
PAl 184	Low Seawater Supply Pressure	Flue gas	S.W. cooling down	OK
h 129	Seawater Pump Running Alarm	Flue gas	Stop all	OK
LAh 193	High Sea Water Level in Scrubbe	Flue gas	Stop all	OK
h 260	Position Error Valve 260	Flue gas	S.W. cooling down	OK
	Boiler 1 Running Failure	Flue gas	S.W. cooling down	OK
	Boiler 2 Running Failure	Flue gas	S.W. cooling down	OK
h 5 TG	Position Error Valve 5 TG	T.U.Gen	Air cooling down	OK
h 14-TG	Position Error Valve 14 TG	T.U.Gen	Stop all	OK
h 83	Fuel Oil Pump Running Alarm	T.U.Gen	SW and Air Cooling down	OK

DATE:
SIGN:

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS FLUE GAS SYSTEM

FAT - ALARM AND SHUT DOWN TEST

ITEM NO	DESCRIPTION	SAFETY ACTION	COMMENT	CHE-CKED
h 109	Blower Running Alarm TG	T.U.Gen	S.W. cooling down	Ok
h 124	Sea Water Pump Running Alarm TG	T.U.Gen	Air cooling down	Ok
PAI 180	Low Combustion Air Pressure	T.U.Gen	S.W. cooling down	Ok
Pah 180	High Combustion Air Pressure	T.U.Gen	S.W. cooling down	Ok
PAI 184	Low Seawater Supply Pressure FG	T.U.Gen	Air cooling down	Ok
PAI 185	Low Fuel Oil Supply Pressure	T.U.Gen	SW and Air Cooling down	Ok
LAI 191	Low SW Level in Cooling Jacket	T.U.Gen	Cooling down	Ok
LAh 193	High Sea Water Level in Scrubbe	T.U.Gen	Stop all	Ok
BA 200	Flame Off Alarm	T.U.Gen	SW and Air Cooling down	Ok
BA 200	Flame On Alarm	T.U.Gen	SW and Air Cooling down	Ok
h 315	Emergency Stop Active	Common	Stop all	Ok
h 1	Position Error Valve 1	Common	Stop all	Ok
h 2	Position Error Valve 2	Common	Stop all	Ok
h 6	Position Error Valve 6	Common	Stop all	Ok
Pah 182	High Deck Pressure	Common	Valve to deck closed ECR + WH	Ok
Pall 182	Very Low deck Pressure	Common	Stop of cargo pumps	Ok
PAI 183	Low Instrument Air Supply Pressure	Common	Stop all	Ok
PAI 187	Low Deck Pressure	Common	Alarm. ECR + WH	Ok
Tah 188	High IG Temperature in Scrubber	Common	SW and Air Cooling down	Ok
TT 188	Signal Fault Inert Gas Temperature	Common	Alarm	Ok
PAI 189	Low Sea Water Pressure to DWS	Common	Valve to deck closed	Ok
LAI 194	Low Sea Water Level in DWS	Common	Block consumer valve	Ok
Aah204	High O2 Content	Common	Valve to deck closed ECR + WH	Ok
Aal204	Low O2 Content	Common	Valve to deck closed ECR + WH	Ok
h 300	Control Power Failure	Common	Stop all	Ok

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS FLUE GAS SYSTEM

FAT - ALARM AND SHUT DOWN TEST

ITEM NO	DESCRIPTION	SAFETY ACTION	COMMENT	CHE-CKED
249	Signal to alarm siren		To ship system	Ok
h 40	Common alarm TG panel		To ship system	Ok
Q 5.6	Common alarm ship		To ship system	Ok
Q 5.10	Common alarm TG		To ship system	Ok
	Indications sub panel ECR			Ok
	Indications sub panel WH			Ok
	Buzzer sub panel ECR			Ok
	Buzzer sub panel WH			Ok
Q 5.7	Blocking of soot blow boiler 1		To ship system	Ok
Q 5.8	Blocking of soot blow boiler 2		To ship system	Ok
Q 5.4	Blocking of cargo pump		To ship system	Ok
Q 5.9	System running signal		To ship system	Ok

LOCATION OF COMPONENTS/CABLES POWER DISTRIBUTION PANELS CHECKED :	Ok
LOCATION OF COMPONENTS/CABLES INTRINSIC PANELS CHECKED :	ok

HAMWORTHY MOSS INERT GAS SYSTEM

FAT - SIMULATED RUNNING AND SHUT DOWN TEST IN EMERGENCY MODE

ITEM NO	DESCRIPTION	SAFETY ACTION	COMMENT	CHE-CKED
IAI 180-1	Blower 1 Low Load FG	Stop all	PLC power off	Ok
IAI 180-2	Blower 2 Low Load FG	Stop all	PLC power off	Ok
PAI 183	Low Instrument Air Supply Pressure	Stop all	PLC power off	Ok
PAI 184	Low Seawater Supply Pressure FG	Stop all	PLC power off	Ok
Tah 188	High IG Temperature in Scrubber	Stop all	PLC power off	Ok
Tah 192	Gas inside scrubber temp. high	Stop all	PLC power off	Ok

DATE: 19.09.07
SIGN:

Hamworthy
FLUID INNOVATION

HAMWORTHY MOSS FLUE GAS SYSTEM

FAT - FUNCTION TEST OF VALVES

ITEM NO	FUNCTION	TYPE	ZSH/ ZSL	SOL	COMMENT	CHE-CKED
1	Main supply	Common	X			OK
2	Vent to atmosphere	Common	X			OK
4	Uptake gas valves sealing air	Flue gas	X	X		OK
5F	Sea water supply	Flue gas	X	X		OK
5G	Sea water supply	T.U. gen.	X	X		OK
6	Constant pressure outlet valve	T.U. gen.	X			OK
7	Gas outlet blower No.1	Flue gas	X			OK
8	Gas outlet blower No.2	Flue gas	X			OK
10	Gas inlet blower No.1	Flue gas	X			OK
11	Gas inlet blower No.2	Flue gas	X			OK
14F	Sea water effluent overboard	Flue gas	X			OK
14G	Sea water effluent overboard	T.U. gen.	X			OK
19	Sea water aux. supply valve	Flue gas.	X			OK
24-1	Uptake gas from boiler No.1	Flue gas	X	X		OK
24-2	Uptake gas from boiler No.2	Flue gas	X	X		OK
26	Common line gas uptake	Flue gas	X	X		OK
53	Air cleaning of gas uptake valves	Flue gas		X		OK
141	Main supply	Common		X		OK
152	Air to ignition burner	T.U. gen.		X		OK
153	Oil resirculation line	T.U. gen.		X		OK
156	Oil to main burner	T.U. gen.		X		OK
157	Air flush of oil gun	T.U. gen.		X		OK
158	Oil to ignition burner	T.U. gen.		X		OK
260	Hatch for air inlet	Flue gas	X			OK
PY7	Blower 1 capacity valve	Flue gas			4 – 20 mA	OK
PY8	Blower 2 capacity valve	Flue gas			4 – 20 mA	OK
PY2	Vent to atmosphere valve	Common			4 – 20 mA	OK
PY6	TG capacity valve	T.U. gen.			4 – 20 mA	OK

DATE: 19.09.07
SIGN:

automation

Sjekkliste kvalitetskontroll

Quality control check list *Inertgas*

	Revisjon 0
Dato: 01.09.2004	Godkient av: HWP

Ordre nr./*Order no.* Prosjekt/*Project* : 100890			
Anleggstype/*Plant description*	: Local panel TG		
Kunde/*Customer Ordre nr./ Order no*	: 130959-61455		
Kunde aksept /*Customer accept*	:	(Sign.) **Klasse insp./*Class surveyor*:**	(Sign.)

Dato/ Date 18/5-07		Mont	QA	Merknader/remarks	Merknader utført/ Remarks completed
1	Koblingstest/ Wiring test	K.O	/		
2	Funksjonstest/ Function test	K.O	/	ikke funksjonstesta.	
3	Komp.i hht. stykkliste/ Comp. acc.to partslist	K.O	SQ	;	
4	Merking av komponenter/ Marking of components	K.O	SQ		
5	Skilting på front/ Nameplate/lavels on front	N.A	NA	ikke frontskilt.	
6	Jording av dør/plate/komp Earthing frame/door/comp	N.A	SQ		
7	Tiltrekking/ Tighten	K.O	SQ		
8	Korrekt styre og hovedspenning/ Correct control and main voltage	K.O	SQ		
9	Spe. førende deler avdekket/ Protection of live parts	K.O	SQ		
10	Nipler og nøkler medlevert/ Glands, keys delivered	K.O	SQ		
11	Tegninger vedlagt/ Drawings attached	N.A	/	Kunde	
12	Skader i overflate på kapsling/ Damage on enclosures surface	N.A	SQ		
13	Visuell kontroll Visual control	K.O	SQ		
14	Bilder for dokumentasjon/ Photo`s for documentation		SQ		
15	Rengjøring/ Cleaning	K.O	SQ		

ABS

MISCELLANEOUS SURVEY REPORT

SURVEY OF: TWO -2- GAS FANS			
Report No.: TU 863404	Date: 9 November 2007	Port: Helsinki, Finland	
Vessel's Name: N/A		CID: 514225	
Manufacturer: FLEBU EESTI OU, TALLINN, ESTONIA		Mfg.No.: 22338/81565	
Purchaser/Builder/S.Y.: FLEBU INTERNATIONAL AS, NORWAY		PO No.: 130959	
Location: HAMWORTHY KSE MOSS		Rating (KW): 65	
Serial Number: 22338-1,2		Weight: N/A	Test Pressure: N/A
Material Test Report No. or Mill Sheets Verified: VERIFIED		Service Use: FAN	
Drawing No. and Date Approved or for Multiple Drawing, Plan Approval Office:		ABS Markings AB TU 863404	

THIS IS TO CERTIFY that the undersigned Surveyor to this Bureau attended for the above survey and reports as follows:

STATEMENT OF FACT

TWO -2- GAS FAN UNITS:

Type: BK25-1
Serial nos.: 22338-1,2
Drive: Direct drive, impeller is assembled on the motor shaft.
Wheel diam.: Ø920/35,5mm

Ratings: Speed: 3560 rpm Capacity: 1,31 m^3/s
Motor: ABB 65kW Pressure: 20,6 kPa

The fans were tested according to Manufacturer´s test procedures.

Mats Kinnula Surveyor, American Bureau of Shipping

Surveyor, American Bureau of Shipping

(If additional space is required, use other side of this form)

NOTE: This Report evidences compliance with one or more of the Rules, guides, standards or other criteria of American Bureau of Shipping and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. This Report is a representation only that the vessel, structure, item of material, equipment, machinery or any other item covered by this Report has met one or more of the Rules, guides, standards or other criteria of American Bureau of Shipping as of the date of issue. Parties are advised to review the Rules for the scope and conditions of classification and to review the survey records for a fuller description of any restrictions or limitations on the vessel's service or surveys. The validity, applicability and interpretation of this Report is governed by the Rules and standards of American Bureau of Shipping who shall remain the sole judge thereof. Nothing contained in this Report or in any notation made in contemplation of this Report shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

Details of Survey (continued)

Surveyor, American Bureau of Shipping

Surveyor, American Bureau of Shipping

	YES	NO	N/A
1. *Manufacture or finishing carried out according to:*			
a) approved plans and to section as applicable of the ABS Rules for SVR	☐	☐	☒
b) Purchaser's specifications.	☒	☐	☐
2. Testing carried out as required by Rules/Specifications and as reported herein	☒	☐	☐
3. Welding plans, procedures & welder qualifications have been reviewed as required by Rule/Specifications and as reported herein	☒	☐	☐
4. Nondestructive Examination was carried out as required by Rules/Specifications and as reported herein	☐	☐	☒
5. Calibration of testing/measuring equipment confirmed, with records maintained at facility or located Flebu Eesti	☒	☐	☐
6. Components stamped with report number and ABS markings	☒	☐	☐
7. ***Subject to satisfactory installation, testing and trials after installation onboard the vessel.***	☐	☐	☒

AB 113 Distribution

Client CID 514225	1
ABS Office @ Destination	
ABS Houston CDC	1
Local	1
Other	

REVIEWED By: _____ 13 November 2007 Gothenburg, Sweden
Signature Date Port