



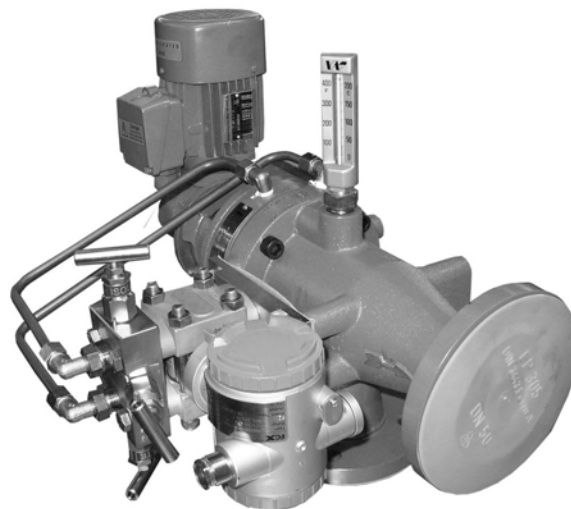
Viscotherm®

Series V92 Sensor/Electronic dP-Transmitter Assembly

T E C H N I C A L M A N U A L

739

INSTRUCTIONS FOR INSTALLATION, OPERATION
AND MAINTENANCE



Publ. Nr. TIB-739-GB-0505
Supersedes TIB-739-GB-0405



H. Hermann Ehlers GmbH

An der Autobahn 45
28876 Oyten
Tel. 04207/91 21-0
Fax 04207/91 21 -41

Email : verkauf@ehlersgmbh.de

WARRANTY CONDITIONS

1. Without prejudice to the restrictions stated hereinafter, the contractor guarantees both the soundness of the product delivered by him and the quality of the material used and/or delivered for it, insofar as this concerns faults in the product delivered which do not become apparent during inspection or transfer test, which the principal shall demonstrate to have arisen within 12 months from delivery in accordance with sub article 1a, exclusively or predominantly as a direct consequence of unsoundness of the construction used by the contractor or as a consequence of faulty finishing or the use of poor materials.

1a. The product shall be deemed to have been delivered when it is ready for inspection (if inspection at the premises of the contractor has been agreed) and otherwise when it is ready for shipment.

2. Articles 1 and 1a shall equally apply to faults which do not become apparent during inspection or transfer test which are caused exclusively or predominantly by unsound assembly/installation by the contractor. If assembly/installation is carried out by the contractor, the guarantee period intended in article 1 shall last 12 months from the day on which assembly/installation is completed by the contractor, with the understanding that in this case the guarantee period shall end not later than 18 months after delivery in accordance with the terms of sub article 1a.

3. Defects covered by the guarantee intended under articles 1, 1a and 2 shall be remedied by the contractor by repair or replacement of the faulty component either on or off the premises of the contractor, or by shipment of a replacement component, this remaining at the discretion of the contractor. Sub article 3a shall equally apply if repair or replacement takes place at the site where the product has been assembled/installed. All costs accruing above the single obligation described in the first sentence, such as are not restricted to shipment costs, travelling and accommodation costs or disassembly or assembly costs insofar as they are not covered by the agreement, shall be paid by the principal.

3a. If repair or replacement takes place at the site where the product has been assembled/installed, the principal shall ensure, at his own expense and risk, that:

- a. the employees of the contractor shall be able to commence their work as soon as they have arrived at the erection site and continue to do so during normal working hours, and moreover, if the contractor deems it necessary, outside the normal working hours, with the proviso that the contractor informs the principal of this in good time;
 - b. suitable accommodation and/or all facilities required in accordance with government regulations, the agreement and common usage, shall be available for the employees of the contractor;
 - c. the access roads to the erection site shall be suitable for the transport required;
 - d. the allocated site shall be suitable for storage and assembly;
 - e. the necessary lockable storage sites for materials, tools and other goods shall be available;
 - f. the necessary and usual auxiliary workmen, auxiliary machines, auxiliary tools, materials and working materials (including process liquids, oils and greases, cleaning and other minor materials, gas, water, electricity, steam, compressed air, heating, lighting, etc.) and the measurement and testing equipment usual for in the business operations of the principal, shall be available at the correct place and at the disposal of the contractor at the correct time and without charge;
 - g. all necessary safety and precautionary measures shall have been taken and adhered to, and all measures shall have been taken and adhered to necessary to observe the applicable government regulations in the context of assembly/installation;
 - h. the products shipped shall be available at the correct site at the commencement of and during assembly.
4. Defects not covered by the guarantee are those which occur partially or wholly as a result of:
- a. non-observance of the operation and maintenance instructions or other than foreseeable normal usage;
 - b. normal wear and tear;
 - c. assembly/installation by third parties, including the principal;
 - d. the application of any government regulation regarding the nature or quality of the material used;
 - e. materials or goods used in consultation with the principal;
 - f. materials or goods provided by the principal to the contractor for processing;

g. materials, goods, working methods and constructions insofar as are applied at the express instruction of the principal, and materials or goods supplied by or on behalf of the principal.

h. components obtained from third parties by the contractor insofar as that party has given no guarantee to the contractor.

5. If the principal fails to fulfil any obligation properly or on time ensuing from the agreement concluded between the principal and the contractor or any agreement connected to it, the contractor shall not be bound by any of these agreements to any guarantee regardless of how it is referred to. If, without previous written approval from the contractor, the principal commences disassembly, repair or other work on the product or allows it to be commenced, then every agreement with regard to guarantee shall be void.

6. Claims regarding defects must be submitted in writing as quickly as possible and not later than 14 days after the discovery of such. All claims against the contractor regarding faults shall be void if this term is exceeded. Claims pertaining to the guarantee must be submitted within one year of the valid complaint on penalty of invalidity.

7. If the contractor replaces components/products under the terms of his guarantee obligations, the replaced components/products shall become the property of the contractor.

8. Unless otherwise agreed, a guarantee on repair or overhaul work carried out by the contractor or other services shall only be given on the correctness of the manner in which the commissioned work is carried out, this for a period of 6 months. This guarantee only covers the single obligation of the contractor to carry out the work concerned once again in the event of unsound work. In this case, sub article 3a shall apply equally.

9. No guarantee shall be given regarded the inspection conducted, advice given and similar matters.

10. Alleged failure to comply with his guarantee commitments on the part of the contractor shall not absolve the principal from his obligations ensuing from any agreement concluded with the contractor.

11. No guarantee shall be given on products which form a part of, or on work and services on, goods older than 8 years.

CONTENTS

1. PREFACE	6
1.1 GENERAL	6
1.2 SYMBOLS.....	6
1.3 COPYRIGHT	6
2. INTRODUCTION.....	7
2.1 SYSTEM CONFIGURATIONS.....	7
2.2 TO RECORD IMPORTANT SERIAL NUMBERS	7
3. SYSTEM DESCRIPTION	9
3.1 PRINCIPLE OF OPERATION.....	9
3.2 SYSTEM DESCRIPTION	10
4. TECHNICAL SPECIFICATION.....	11
4.1 VISCOTHERM SENSOR	11
4.2 DIFFERENTIAL PRESSURE TRANSMITTER.....	12
5. WARNINGS	13
6. INSTALLATION.....	14
6.1 MECHANICAL INSTALLATION (See Fig. 4).....	14
6.2 ELECTRIC INSTALLATION	15
6.2.1 Electric motor	15
6.2.2 dP-transmitter.....	17
7. DIMENSIONS	18
7.1 SENSOR/dP-TRANSMITTER ASSEMBLY	18
7.2 SEPARATE SENSOR AND dP-TRANSMITTER.....	20
8. OPERATION	21
8.1 INITIAL START-UP.....	21
8.2 ROUTINE START-UP	22
8.2.1 Routine start-up with diesel oil in system.....	22
8.2.2 Routine start-up with heavy fuel oil in system	22
8.3 SHUT-DOWN	22
8.3.1 Shut-down with change-over from HFO to diesel oil.....	22
8.3.2 Shut-down on Heavy Fuel Oil	22
9. MAINTENANCE.....	23
9.1 GENERAL	23
9.2 MONTHLY ZERO CHECK OF dP-TRANSMITTER.....	23
9.3 2-YEARLY (OR EVERY 10,000 HOURS).....	28
9.3.1 Range check of dP-transmitter	28
9.3.2 To clean gearbox.....	28
9.4 TO CLEAN MEASURING CAPILLARY	29
9.5 TO REPLACE ELECTRIC MOTOR OF VISCOTHERM [®] SENSOR.....	30
9.6 OTHER MAINTENANCE/REPAIR.....	30
10. TROUBLE SHOOTING	31
10.1 VISCOSITY SIGNAL TOO LOW.....	31
10.2 VISCOSITY SIGNAL TOO HIGH.....	31

10.3	VISCOSITY SIGNAL REMAINS AT MAXIMUM VALUE.....	32
10.4	NO VISCOSITY SIGNAL	32
11.	MAINTENANCE RECORD.....	33
11.1	LISTING OF MAINTENANCE OPERATIONS.....	33
12.	PARTS LISTS	34
12.1	SPARE PARTS KITS.....	34
12.2	VISCOTHERM SENSOR PARTS.....	36
12.3	DIFFERENTIAL PRESSURE TRANSMITTER PARTS	43

1. PREFACE

1.1 GENERAL

This manual contains installation, operation and maintenance instructions for VAF Viscotherm® Series V92 Electronic Viscosity Sensor/dP-Transmitter assemblies with dP-Transmitter type Fuji.

This manual contains important information for the installer, the operator and for your maintenance department.



To ensure safe and correct installation and operation of your Viscotherm system read this manual completely before starting operations.

The V92 sensor/transmitter assembly may be part of a complete viscosity control system. For associated equipment supplied by VAF Instruments B.V. refer to the instruction manuals packed with those products.

For any additional information contact:

H. Hermann Ehlers GmbH
An der Autobahn 45
28876 Oyten
Germany

Tel. +49 4207 91 210
Fax +49 4207 91 21 41
E-mail: sales@ehlersgmbh.de
Internet: www.ehlersgmbh.com/de

1.2 SYMBOLS

The symbols below are used to call attention to specific types of information.



A warning to use caution! In some instances, personal injury or damage to the Viscotherm unit or control system may result if these instructions are not followed properly.



An explanation or information of interest

1.3 COPYRIGHT

This manual is copyrighted with all rights reserved. No part of this manual may be copied or reproduced by any means.

While every precaution has been taken in the preparation of this manual, no responsibility for errors or omissions is assumed. Neither is any liability assumed for damages resulting from the use of the information contained herein. Viscotherm is a registered trademark of VAF Instruments B.V.

2. INTRODUCTION

2.1 SYSTEM CONFIGURATIONS

A Series V92 sensor/transmitter assembly may be part of a complete VAF viscosity control system. For information and instructions covering the other components of this system, refer to the separate technical manuals which are supplied with these components.

The Viscotherm electronic viscosity control system is available in three basic configurations:

- Series V92 for use with steam or thermal oil operated fuel heaters.
- Series V92 for use with electric fuel heaters.
- Series V92 computerized viscosity/temperature control system for use with thermal oil or steam operated fuel heaters.

2.2 TO RECORD IMPORTANT SERIAL NUMBERS

Identify your Viscotherm unit by comparing the type number on the minus ('-') tag plate of the sensor with the description on the packing list. Ensure that the instrument is suitable for your purposes.

Before installing a Viscotherm sensor/transmitter assembly record type and serial numbers, stamped on the + and - tag plates on the sensor housing, in the space below (Fig. 1).



Always quote the instrument serial number when contacting the factory or local service representative

VAF INSTRUMENTS
Dordrecht, The Netherlands

TYPE MAX. °C

SERIAL No.

MAX. WORKING PRESSURE bar

RANGE VAR. No.

ONLY TO BE USED TOGETHER WITH

DP CELL

CONTROLLER

Fig. 1, Space for recording numbers on tag plates of sensor housing

For identification purposes it is recommended to record also nameplate data of other Viscotherm system components.

Component	Nameplate data

3. SYSTEM DESCRIPTION

3.1 PRINCIPLE OF OPERATION

Viscotherm is a capillary type of viscosity instrument and measures the dynamic viscosity of Newtonian fluids. The sensor (Fig. 2) consists of a housing (4) in which the measuring element, a capillary tube assembly (2 & 3), is mounted together with a gear pump (9). An electric motor (6) with reduction gear (7) drives the pump such that a continuous flow through the capillary tubes is achieved. The laminar flow through the measuring capillary creates a pressure differential which is proportional to the dynamic viscosity of the fuel. A magnetic coupling (8) prevents both leakage and overload of the electric motor in the event of an obstructed pump.

The capillary assembly consists of a measuring capillary in a resilient stainless steel housing (3) and a stainless steel damping capillary (2) which compensates for pressure waves in the fuel lines. Pressure taps (5) are provided to connect the inlet and outlet of the measuring capillary to a differential pressure transmitter via a valve manifold. An optional thermometer (1) indicates the actual fuel temperature.

The electronic dP-transmitter converts the differential pressure across the capillary into a 4 - 20 mA signal. The transmitter is normally factory mounted and piped to the sensor, but can also be supplied as a separate item for installation by the user in a convenient location.

A valve manifold block is used to isolate the dP-transmitter connections and to equalize the differential pressure across the transmitter.

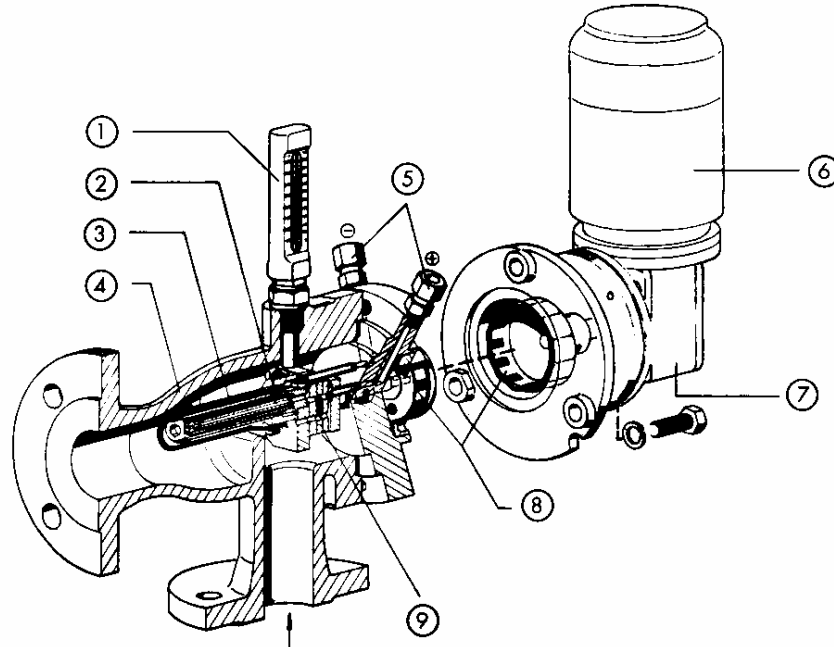


Figure 2, Sectional view of Viscotherm sensor

3.2 SYSTEM DESCRIPTION

Figure 3 shows a typical fuel system with return line from the engine. In this configuration, the degassing/mixing tank operates as a fuel buffer, ensuring gradual changes of viscosity.

The actual control of viscosity is done by the Viscotherm system. The signal from the dP-transmitter is compared to the setpoint of the viscosity controller, which regulates the output to the fuel heater via a control element (control valve or electric heater cabinet).

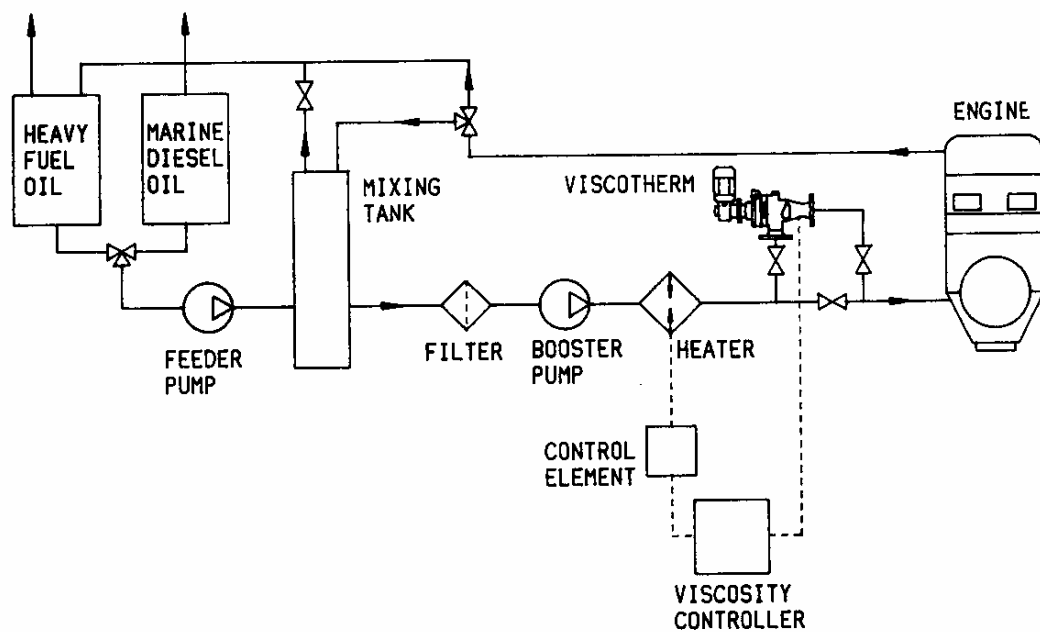


Figure 3, Typical fuel system with return line

4. TECHNICAL SPECIFICATION

4.1 VISCOTHERM SENSOR

Viscosity measuring range	see minus (' - ') dataplate on sensor
Flange connections	DN 50 mm (2")
Flange rating	see packing list or order confirmation
Materials	
Body	cast steel or ductile iron
Capillary ass'y	AISI 304/440
Gear pump	stainless steel
Max. working pressure	see minus (' - ') dataplate on sensor
Max. ambient temperature	60°C (140°F)
Max. fuel oil temperature	200°C (392°F); see minus (' - ') dataplate on sensor
Maximum fuel flow rate	35 m ³ /h
Output signal range	0...62 kPa differential pressure
Connections to valve manifold and dP transmitter	10 mm pipe couplings
Response time	approx. 1 minute
Accuracy	better than +/- 2% (see note below)
Thermometer (optional)	0 - 200°C / 0 - 392°F
Net weight sensor/ dP-transmitter assembly	32 kilos
Noise level	Minimal, never exceeding 70 dB(A)
Electric motor	
Supply voltage	see dataplate on electromotor
Insulation class	VDE 0530, IEC 34-1, class F. Tropical insulation acc. Lloyds Register of Shipping
Protection class	see dataplate on electromotor
Power consumption	see dataplate on electromotor
Cable gland	M20 x 1.5 suitable for 6 -12 mm cable diameter

Note:

The measuring accuracy applies only when a constant frequency of the supply power (as indicated on the electric motor) is maintained.

4.2 DIFFERENTIAL PRESSURE TRANSMITTER

Output signal	4 to 20 mA DC 2-wire linear signal
Supply voltage	10.5 to 28 VDC
Cable gland	12 to 14 mm cable diameter
Protection class	IEC IP67 and NEMA 4X
Parameters relating to the safety:	
Max. supply voltage	45 V
Max. current	22 mA
Max. power	1 W
Supply voltage effect	Less than 0.05% of calibrated span per 10V
Temperature effect	Shift at 20% output point between limits of -40°C and +85°C: +/- 1.25% / 55°C at (1 to 1/2.5) x upper range limit
Temperature limits	Ambient -40 to +85 °C (-40 to +185 °F) Storage -40 to +100 °C (-40 to +212 °F)
Max. relative humidity	100%
Max. static pressure	14 MPa (140 bar; 2,000 psi)
Single sided pressure overload	+/- 0.4% /14 MPa (140 bar; 2,000 psi)
Materials	
Process cover	316 stainless steel
Wetted sensor body	316 stainless steel
Non-wetted parts	Low copper die-cast aluminium alloy electronics housing, finished with epoxy/polyurethane double coating
Diaphragm	316L stainless steel
Manifold housing	AISI 316
Manifold spindles	AISI 316
Filling liquid	Silicone oil
Manifold block	2 isolating valves, 1 equalising valve
Process connections	10 mm pipe couplings for 10 mm o.d. steel piping
Zero/span adjustment	Zero is adjustable from an external screw. This screw can also function to adjust span when 'mode' switch (located on the electronics unit) is in the span mode.
Net weight incl. manifold	5 kgs

5. WARNINGS



WARNINGS

To ensure safe and correct installation take due note of the following installation hints.

- Use appropriate lifting and transportation equipment to handle the sensor/transmitter assy. The unit weighs approximately 35 kilos.
- Compare your process variables with the specifications in sections 2.2 and 4 of this manual. Make sure these are compatible.
- Close the junction box of the Viscotherm sensor electric motor before switching power on.
- Beware of electric charge remaining in the capacitor of a 1-phase motor. High voltage may remain on the terminals up to 12 hours after power- down.
- The Viscotherm sensor body will heat up to the process temperature. Do not touch instrument while process is running!
- When a temperature transmitter is supplied as optional extra, the transmitter must be installed in a 2" pipe section between the fuel heater and the Viscotherm sensor.
- **NEVER** install the transmitter in the thermometer location in the sensor housing, due to difference in insertion depth.
- Read and fully understand the instructions in this manual before installing or operating the equipment.

6. INSTALLATION

6.1 MECHANICAL INSTALLATION (SEE FIG. 4)

1. Install Viscotherm sensor with dP-transmitter, shut-off and bypass valves in fuel piping.
2. Avoid stresses on the sensor by using adequate inlet and outlet piping supports.
3. Maximum distance between fuel heater outlet and sensor inlet: 4 metres.
4. Protect sensor and dP-transmitter from humidity, excessive vibration and temperature variation.
5. To enable removal of electric motor and gear box allow at least 0.3 metres clearance to the side of the sensor.
6. If the dP-transmitter must be installed separate from the sensor, mount the transmitter lower than the sensor. Maximum distance between sensor and transmitter: 1.5 metres. Use 10 mm o.d. steel piping to interconnect sensor and transmitter.
7. Sensing lines between sensor and transmitter must be heated when fuel viscosity is 250 mPa.s or thicker. Use steam tracing or 20 Watts/metre resistance wiring.

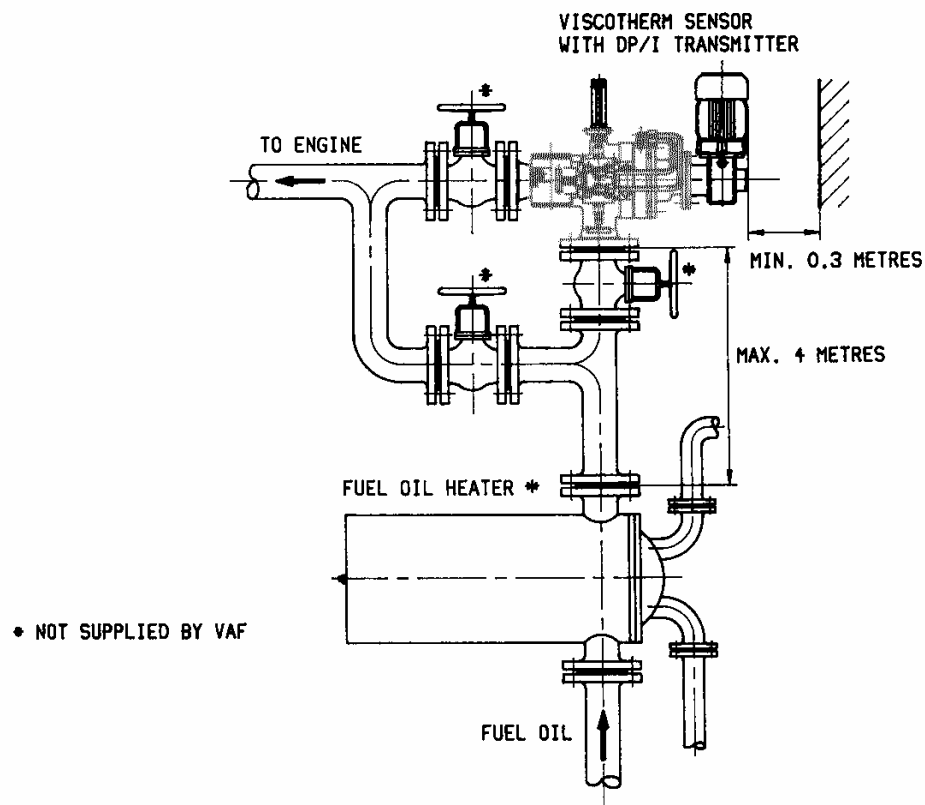


Figure 4, Installation diagram of sensor/transmitter assembly

6.2 ELECTRIC INSTALLATION

6.2.1 Electric motor

(Figure 5)



Make sure that voltage and frequency of electric motor are in accordance with local mains.
Make electrical connections in accordance with local regulations.

1. Connect motor as indicated in the relevant picture of figure 5, using 1.5 mm² wire.
2. For 3-phase motor: check direction of rotation with arrow on motor mounting console.
If not correct:
 - switch off power to motor
 - open junction box of motor
 - reverse 2 of the 3 connecting wires
 - close junction box
 - switch power on

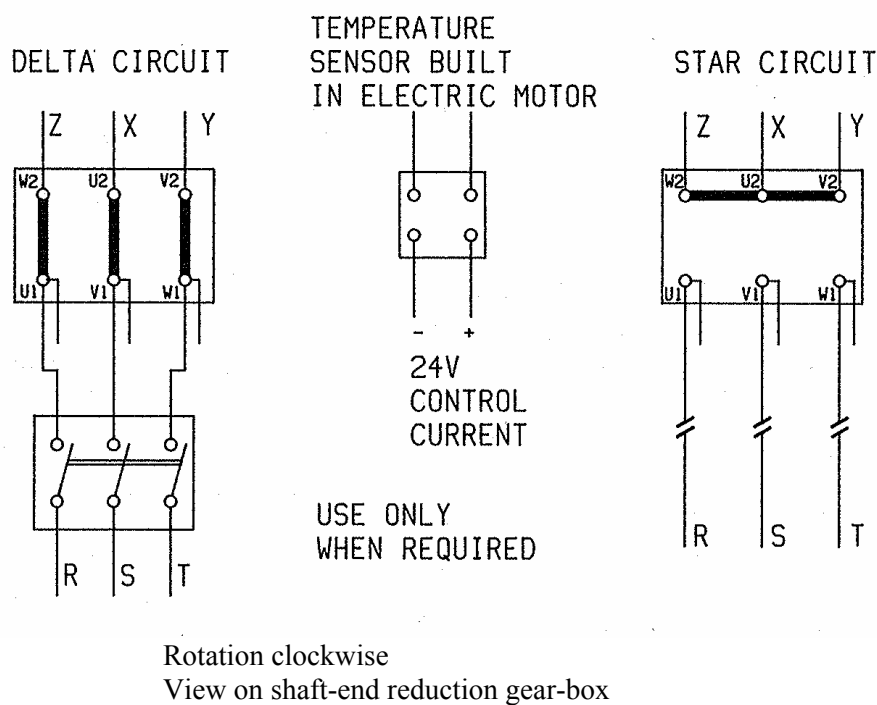


Figure 5A, Connection diagrams electric motor (3-phase AC) motor of Viscotherm[®] sensor

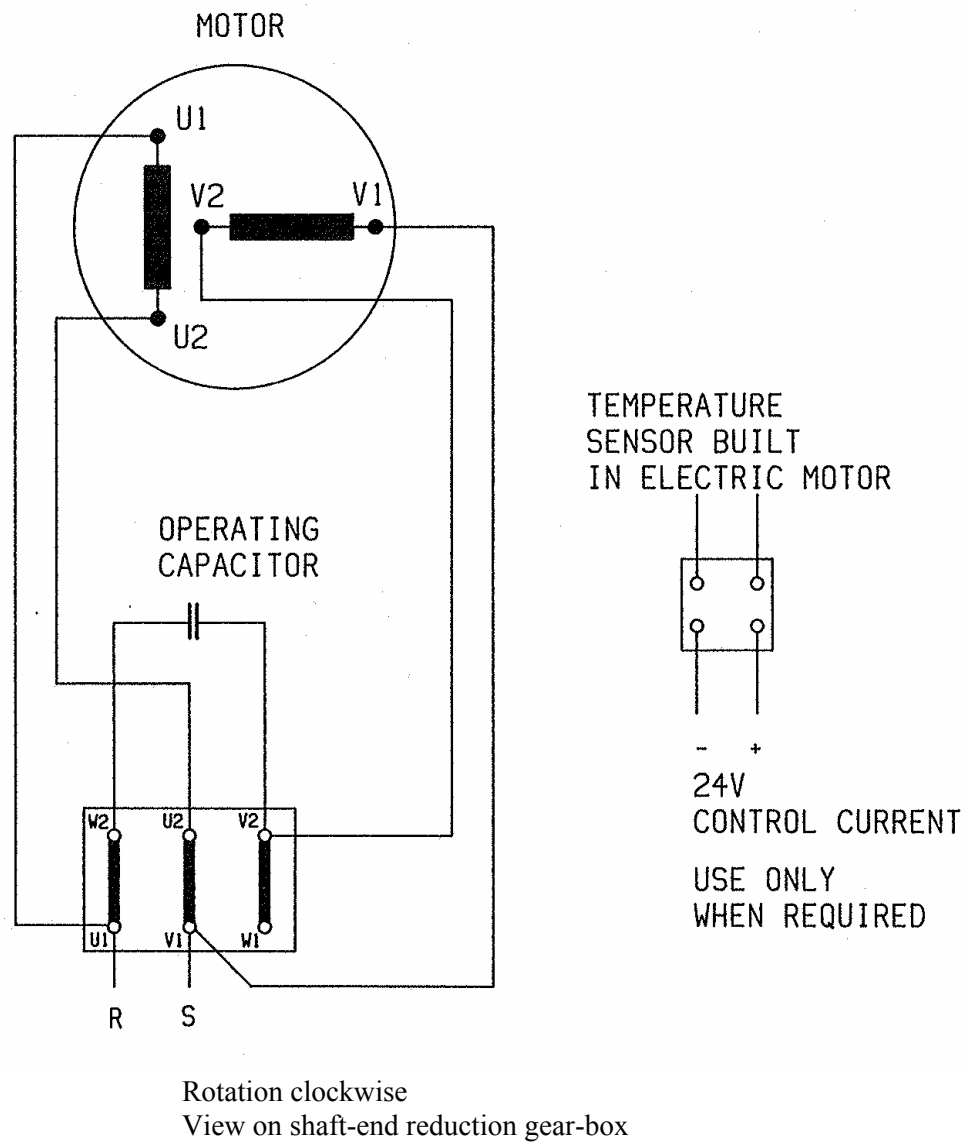


Figure 5B, Connection diagrams electric motor (1-phase AC) motor of Viscotherm[®] sensor

6.2.2 dP-transmitter

(Figure 6)

1. Unscrew cover of dP-transmitter and make electric connections through cable gland. Use 12-14 mm o.d. cable with a minimum wire diameter of 0.5 mm².



Avoid earth loops. Shielding must be connected to ground at one side of the cable only.

2. Screw cover on dP-transmitter.



Make sure that cover sealing ring is installed to maintain protection class IP67

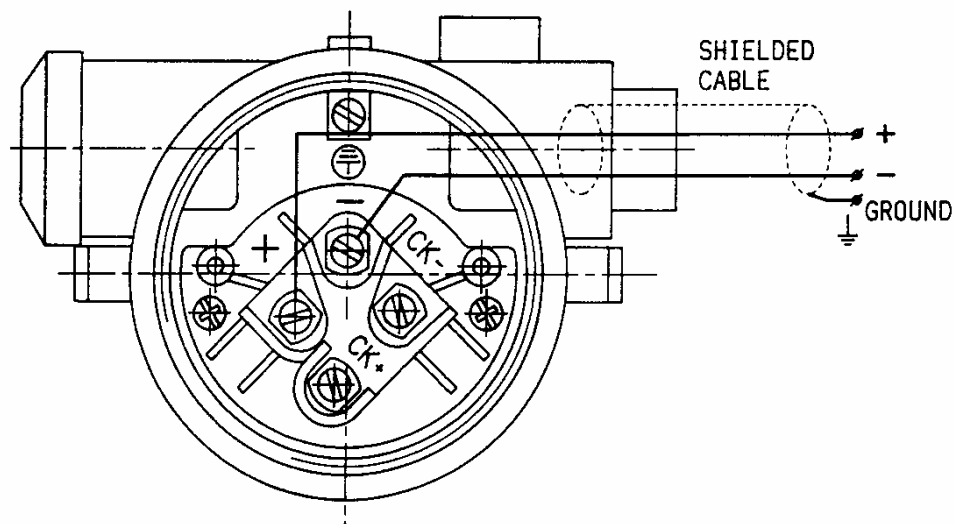
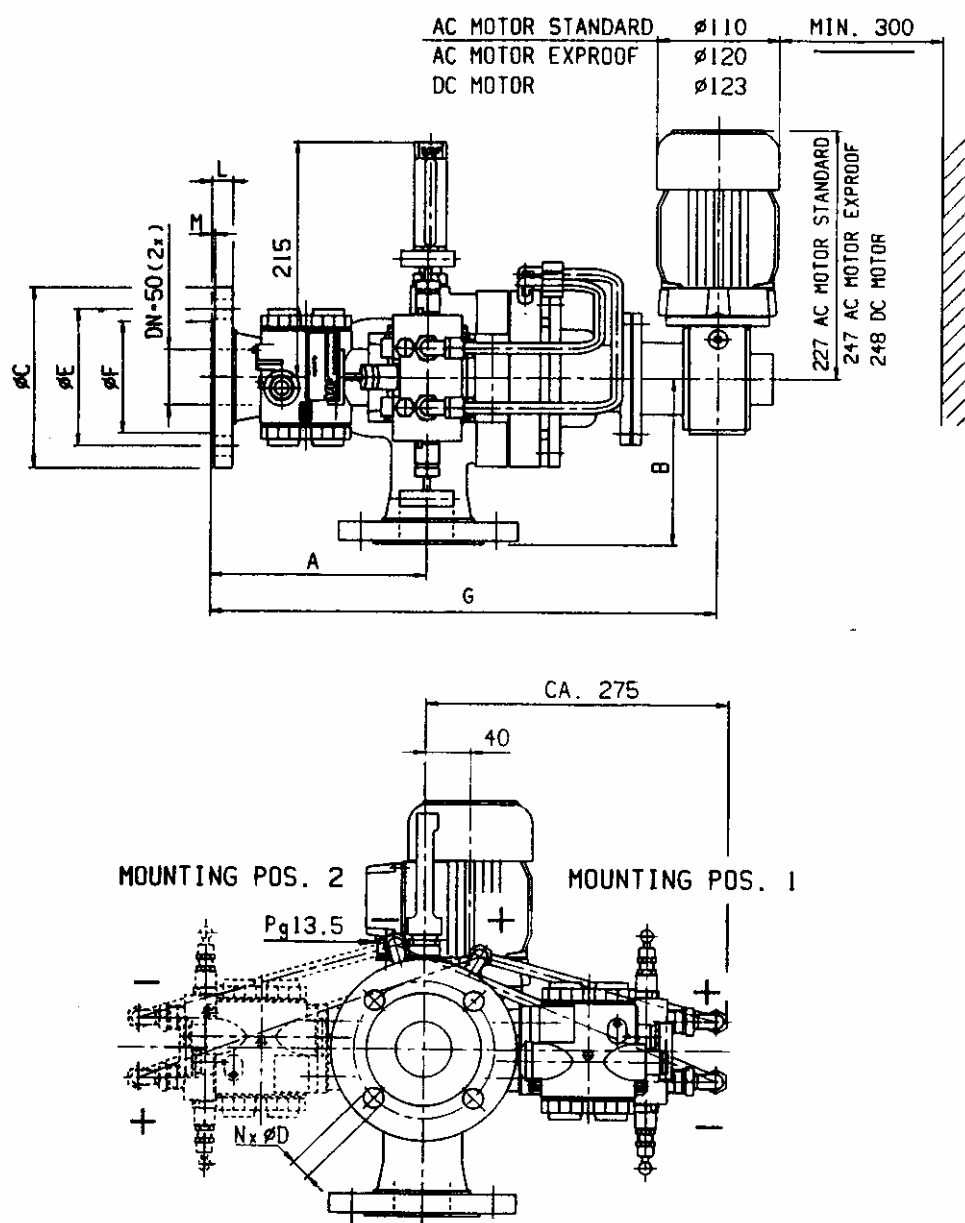


Figure 6, Electric connection diagram of dP-transmitter

7. DIMENSIONS

7.1 SENSOR/DP-TRANSMITTER ASSEMBLY

Dimensions in millimetres.



VAF No.	FLANGE	Max.work pressure	A	B	C	NxøD	E	F	G	L	M
V92050E15	DIN PN16/25/40	40 bar	200	150	165	4X18	125	102	463	20	3
V92050E22	ANSI CLASS 150RF	20 bar	200	150	152.4	4x19	120.6	92	463	20	1.6
V92050E24	ANSI CLASS 300RF	52 bar	203	153	165	8x19	127	92	466	23	1.6
V92050E32	JIS 10K	10 bar	200	150	155	4x19	120	100	463	16	2
V92050E33/34	JIS 16/20K	16/20 bar	200	150	155	8x19	120	100	463	18	2
V92050E35	JIS 30K	30 bar	203	153	165	8x19	130	105	466	23	2
V92050G16	DIN PN64	64 bar	210	160	180	4x22	135	102	473	26	3
V92050G17	DIN PN100	100bar	210	160	195	4x26	145	102	473	28	3
V92050G47	DIN PN 100 DIN2512N	100 bar	210	160	195	4x26	145	102	473	28	3
V92050G25	ANSI CLASS 600RF	104 bar	220	170	165	8x19	127	92	483	32	6.5
V92065E32	JIS 10K-65A	10 bar	210	160	175	4x19	140	120	473	20	2
V92065E33/34	JIS 16/20K-65A	16/20 bar	210	160	175	8x19	140	120	473	20	2

Figure 7, Dimensions sensor/dP-transmitter assembly

7.2 SEPARATE SENSOR AND DP-TRANSMITTER

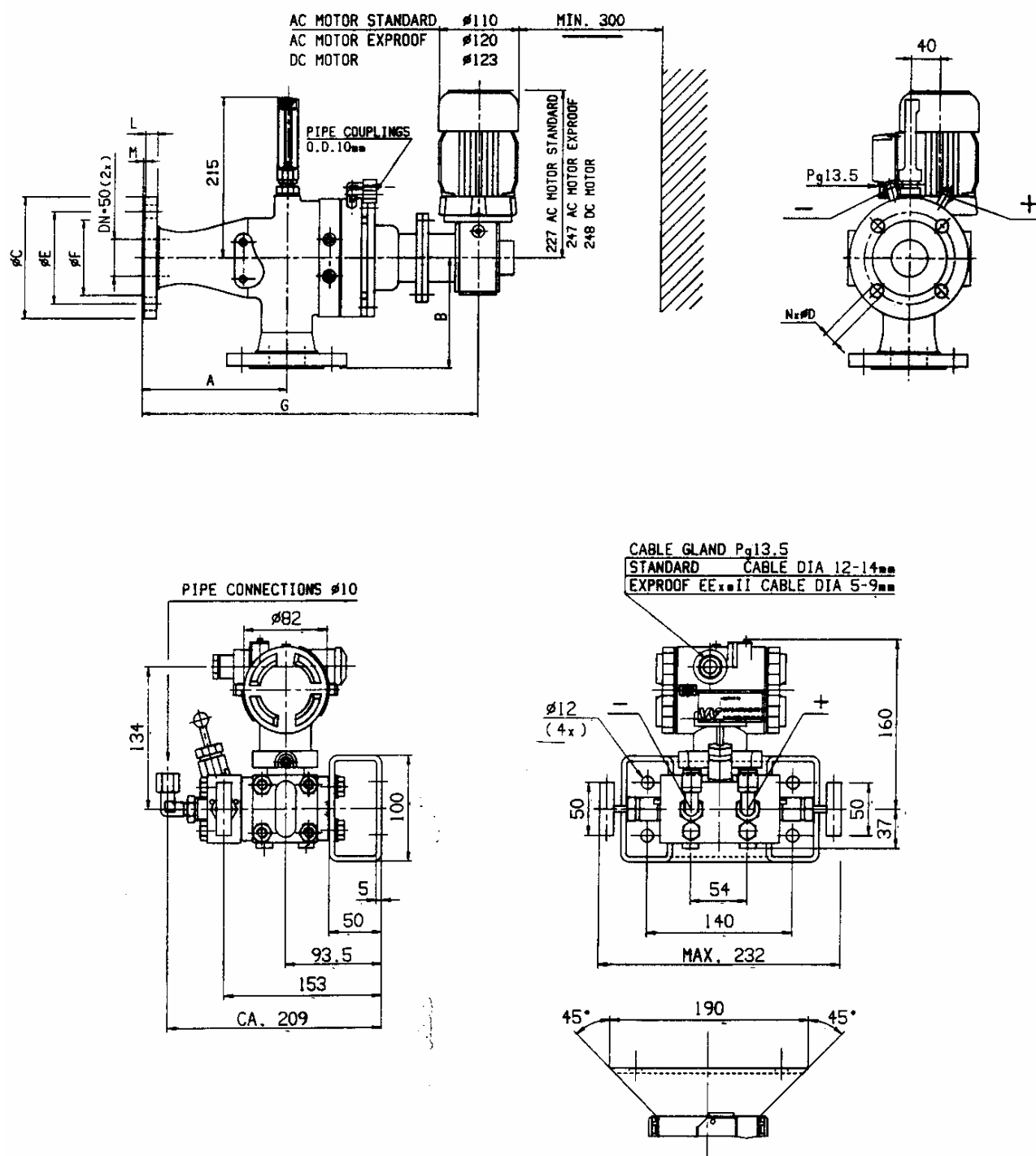


Figure 8, Dimensions separate sensor and dP-transmitter

8. OPERATION

8.1 INITIAL START-UP

1. Close valves A and B and open equalizing valve C at the dP-transmitter manifold (see Figure 9).
2. Allow diesel oil to enter fuel system.
3. Start Viscotherm motor.
4. Vent system by unscrewing pipe coupling in "-" (minus) sensing line between sensor and dP- transmitter. (See Fig. 9 and label on sensor housing).



Diesel oil will flow out. Make sure that system pressure is less than 1 bar and protect eyes before unscrewing coupling.

5. Retighten coupling when the air bubbles stop.
6. Open manifold valves A and B (Figure 9).
7. Check if viscosity reading is at 0 mPa.s. If reading is not 0 mPa.s, adjust zero point of dP-transmitter following instructions in section 9.2.
8. Close equalizing valve C (Figure 9)



When further Viscotherm system components are supplied by VAF Instruments B.V., refer to the technical manuals supplied with these components for additional start-up and operating instructions.

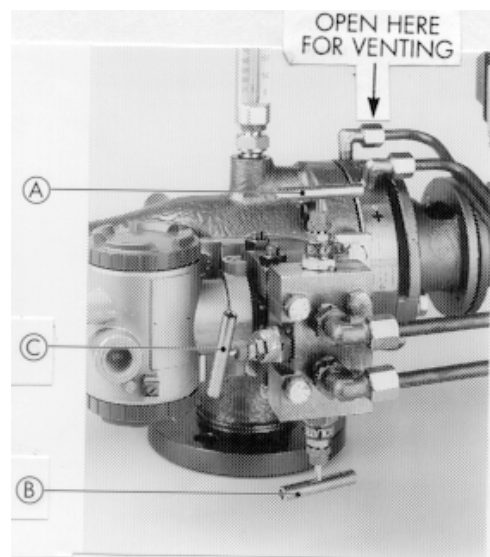


Figure 9, Block valves and equalizing valve on dP-transmitter

8.2 ROUTINE START-UP

8.2.1 Routine start-up with diesel oil in system

When starting up on diesel oil, no special action is required on the Viscotherm sensor and dP transmitter except starting the electric motor on the sensor.

8.2.2 Routine start-up with heavy fuel oil in system

1. Start operation of fuel system (pumps, heat tracing of process lines).
2. Pre-heat fuel. Refer to instructions in Technical Manual for viscosity controller.
3. After the required pre-heating period, start electric motor of Viscotherm sensor.
4. Check viscosity reading. If reading is within range, Viscotherm sensor/transmitter assembly is operational. If reading is higher than maximum value of measuring range, switch off electric motor and proceed with steps 5 and 6.
5. Wait approximately 10 minutes.
6. Switch on electric motor.



Repeat steps 4, 5 and 6 until viscosity reading is within range.

8.3 SHUT-DOWN

To prevent clogging of sensing lines and capillary with heavy fuel oil in the system, it is recommended that flow be switched over to diesel oil before shutting-down of the Viscotherm[®] system.

8.3.1 Shut-down with change-over from HFO to diesel oil

1. Switch over to diesel oil.
2. Open equalising valve (C, Figure 9) on transmitter manifold.
3. Flush Viscotherm sensor with diesel oil for approximately 10 minutes.
4. Switch-off electric motor.
5. Close equalising valve (C, Figure 9).

8.3.2 Shut-down on Heavy Fuel Oil

1. Switch off Viscotherm[®] motor.



Maintain tracing on Viscotherm[®] body and transmitter sensing lines after shut-down.

9. MAINTENANCE

9.1 GENERAL

Under normal conditions the Viscotherm[®] sensor/dP-transmitter assembly requires a minimum of maintenance. "Normal" means:

- a. A clean operating environment.
- b. Viscotherm[®] components installed in accordance with the installation instructions given.
- c. Operation of the viscosity control system in accordance with this manual and other related publications issued by VAF Instruments B.V.



Keep record of all maintenance operations, e.g. using the sheet of section 11.

9.2 MONTHLY ZERO CHECK OF DP-TRANSMITTER

1. Visually inspect each part of the transmitter for damage, corrosion, etc. Check covers and O-rings to ensure that the instrument is water and dustproof. Check piping and connections for leaks.
2. Open equalizing valve C (Figure 9) on transmitter manifold.
3. Switch off electric motor of Viscotherm sensor.
4. Check that viscosity indication on control station is 0 (zero) mPa·s, corresponding with an output of 4 mA.

If not, keep the transmitter energized for at least 10 minutes and adjust zero point as follows:

- a. Remove cover of electronics housing of dP-transmitter.
- b. Check that 'MODE' switch is at 'O' (Fig. 10).

Note: Figure 10 shows an example of wiring when a digital voltmeter is used (connected to CK- and CK+ on the terminal block, see Fig. 6). 0 (zero) mPa·s should then correspond with an output of 4 mA.

- c. Slide away 'ZERO' cover on electronics housing and adjust zero point by turning adjustment screw as shown in figure 11.

5. Switch on electric motor of Viscotherm[®] sensor and close equalizing valve C on dP-transmitter manifold.



Caution: After adjustment of the transmitter, it should be kept energized for about 10 seconds.

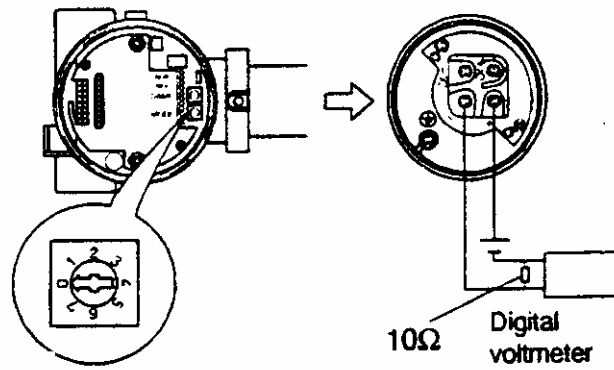


Figure 10, Location of 'MODE' switch

Addendum

In some cases the mode setting switch with positions from 0 to 7 has been replaced by a mode switch with 0 and span position only. Refer to the following procedure:

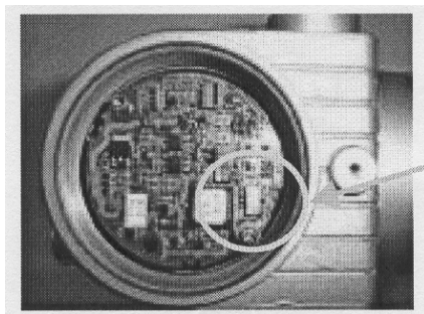
Range change procedure

For changing the measuring range, carry out zero adjustment first, and span adjustment next. (If zero adjustment is performed after span adjustment, the 100% point may not be adjusted correctly, and result of range cannot be expected.)

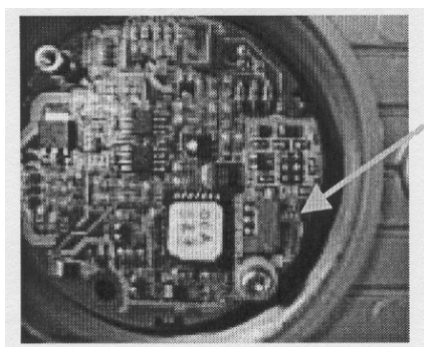
1. Zero adjustment (change Lower Range Value internally)

Zero point of the transmitter is adjustable by the outside screw with the mode setting switch in the housing set at zero position. The figure shown below is an example of “Mode setting switch” is attached.

- (1) Set the mode setting switch to zero position.



Mode setting switch

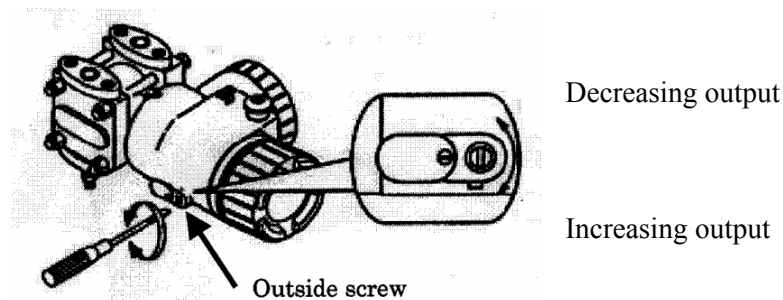


Set switch to “zero” for zero calibration

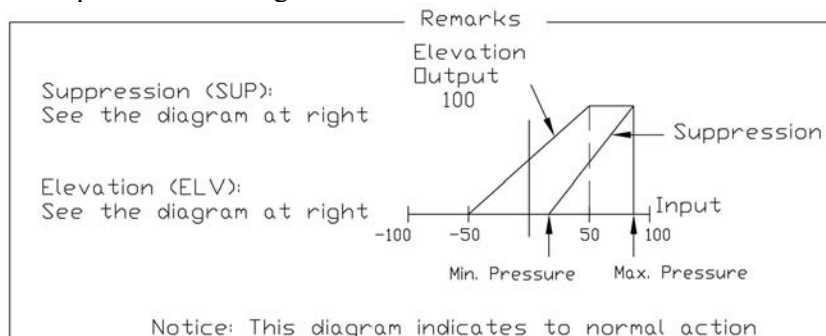
corresponding to new Lower Range Value

- (2) Apply standard input pressure

(3) Adjust output to 4mA by turning the outside screw



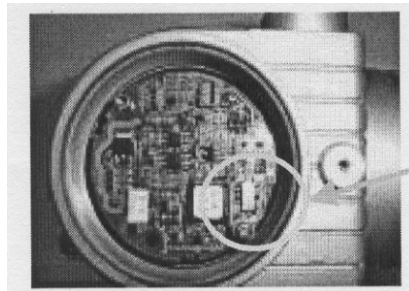
For zero suppression or elevation, apply the specified input pressure in advance and adjust the output to 4 mA using the outside screw.



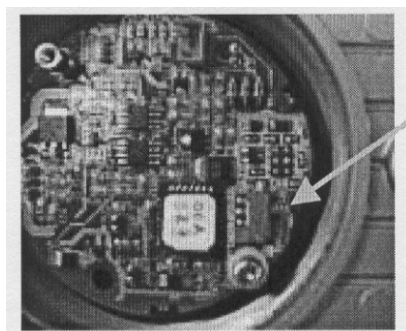
2. Span adjustment (change Upper Range Value internally)

The measuring range for each transmitter is determined according to its type. Span is changed by the outside screw with the mode setting switch in the housing set at span position. The figure shown below is an example of “Mode setting switch” is attached.

(1) Set the mode setting switch to span position.



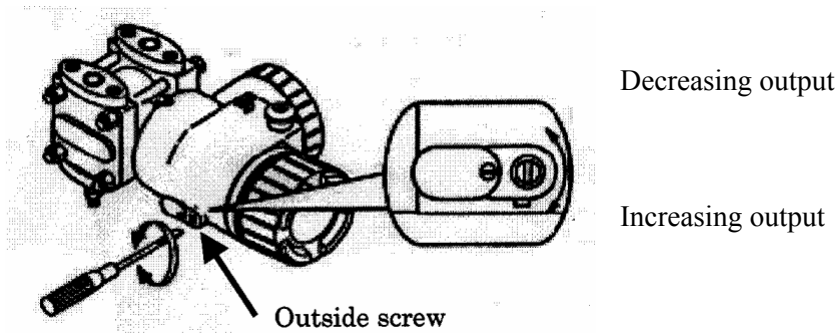
Model setting switch



Set switch to “span” for span calibration

(2) Apply standard input pressure corresponding to new Upper Range Value.

- (3) Adjust output to 20 mA by turning the outside screw.

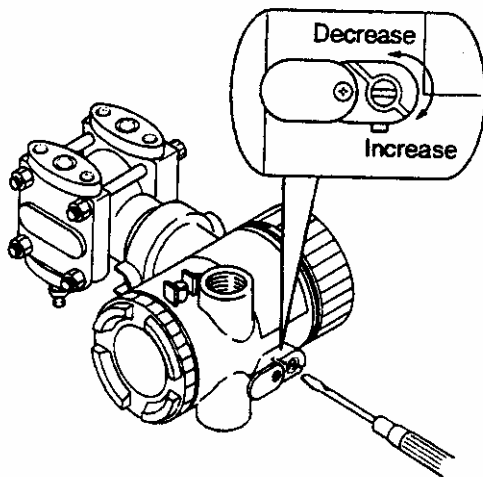


- (4) Then, return to applying input pressure of zero again and make sure output is 4mA.



Important

After adjustment, the transmitter should be kept energized at about 10 seconds to write the adjustment parameter into memory



CALIBRATION DATA	
INPUT ■ ■ WC	OUTPUT ■ A
2220	12
1005	7.53
3315	16

Figure 11, Zero/span adjustment screw

Figure 12, Typical example of calibration data inside cover of dP-transmitter

9.3 2-YEARLY (OR EVERY 10,000 HOURS)

9.3.1 Range check of dP-transmitter

1. Unscrew cover from electronics section of dP-transmitter and read calibration data plate affixed to inside of cover. See figure 12 for a typical example.
2. Make sure that valves A and B of the manifold (Fig. 9) are completely opened and that equalising valve C is completely closed.
3. Connect suitable digital voltmeter as shown in figures 6 and 10.
4. Set 'MODE' switch to zero. (Figure 10) (Reading must be 4 mA).
5. Connect suitable pressure gauge and air supply to "+" side of dP-transmitter.
6. Set 'MODE' switch to span.
7. Apply the maximum input pressure (3315 mm WC in the example of figure 12) to the dP-transmitter and check that this pressure corresponds with the maximum output value (16 mA in the example of figure 12) on the calibration data plate. If required the output current can be adjusted using the zero/span.
8. Repeat steps 2, 3 and 4 of paragraph 9.2 to check that the zero point has not drifted.
9. Remove air tools and voltmeter. Close covers.
10. Switch on electric motor of Viscotherm sensor.



Caution: After adjustment of the transmitter, it should be kept energized for about 10 seconds.

9.3.2 To clean gearbox

1. Remove gearbox and electric motor from main flange of Viscotherm[®] sensor.
2. Remove electric motor from gearbox.
3. Remove side cover of gearbox.
4. Clean gearbox with a solvent. Blow dry with clean, dry air.
5. Mount electric motor on gearbox again. If necessary, use new sealing parts.
6. Fill gearbox with 200 ml lubricating oil.

Oil types: Shell Tivela A, Shell Omala 220, Fina Giran 220, BP Energol 220, Castrol Alphasyn PG 220, or equivalent.

7. Install side cover and mount gearbox/motor assembly to main flange of Viscotherm[®] sensor.



Always use liquid packing when re-assembling.

Make sure that all parts and packing surfaces are thoroughly cleaned.

Lock screws by applying Loctite Nutlock 242 or equivalent sealant..

9.4 TO CLEAN MEASURING CAPILLARY

For parts reference see figure 13.

1. Make sure that electric motor of Viscotherm sensor is switched off and that valves A, B and C (Fig. 9) on manifold of differential pressure transmitter (DPT) are closed.
2. Isolate Viscotherm sensor from fuel system by closing the applicable valves (see Figure 4). Drain sensor as much as possible.
3. Remove electric motor with gearbox and mounting console from sensor by removing washers and screws (6 & 7, Figure 13).
4. Remove both sensing tubes (40 & 41, or 42 & 43) between sensor and DPT.



Caution: Tubes are filled with fuel oil.

5. Remove cap screws and washers (30 & 31) and separate main flange (11...29) from sensor housing.



Caution: Housing is filled with fuel oil.

6. Remove four M4 screws and washers (37 & 38) and remove damping capillary assembly (36) from gearpump. Clean capillary with a solvent.
7. Unscrew complete measuring capillary assembly (35) from gear pump.
8. If measuring capillary tube is fouled, it must be cleaned by soaking in a suitable detergent and cleaning on inside with, for instance, a pipe cleaner.
9. Screw measuring capillary assembly (35) to gearpump (12), using new O-ring (39). Apply just enough torque to secure sealing of O-ring.
10. Install damping capillary assembly (36) to gearpump, using four M4 screws and washers (37 & 38).
11. Install main flange assembly to sensor housing, using four screws and washers (30 & 31). Do not forget to replace main flange packing (4), or use a new packing.
12. Re-install sensing tubes between sensor and DPT.
13. Re-install electric motor with gearbox and mounting console to sensor, using screws and washers (6&7).
14. Start Viscotherm[®] system up in accordance with initial start-up procedures described in section 8.1.

9.5 TO REPLACE ELECTRIC MOTOR OF VISCOTHERM® SENSOR

1. Switch off power to electromotor. Take precautions that it can not be switched on by accident.
2. Open terminal box of motor, label cable connections and disconnect electric wiring. For a DC motor also remove carbon brushes from their holders.
3. Unscrew 4 hexagonal bolts and remove flange from gearbox.



Caution: gearbox is filled with oil.

4. Unscrew 4 hexagonal bolts and remove gearbox from electromotor.
5. Remove grooved pin and wormwheel.
6. Use new or revised motor and assemble in reverse order.



Always use liquid packing when re-assembling.

Make sure that all parts and packing surfaces are thoroughly cleaned.

Lock screws by applying Loctite Nutlock 242 or equivalent sealant.

7. Make sure that the Viscotherm sensor is not filled with cold HFO. Switch the electromotor on and check direction of rotation as indicated by an arrow on the motor mounting console.

9.6 OTHER MAINTENANCE/REPAIR



Any maintenance or repair, not described in Sections 9.1 through 9.5 must be carried out by a service engineer from VAF Instruments or an authorized service engineer from local VAF agent.

For service work on site the service engineer must be provided with all necessary auxiliary labourers, tools, equipment and appliances at the correct place and time. See the Warranty Conditions in this manual.

10. TROUBLE SHOOTING

10.1 VISCOSITY SIGNAL TOO LOW

(May be indicated by incorrect temperature of the fuel).

POSSIBLE CAUSE

CORRECTIVE ACTION

Sensing line between Viscotherm sensor and dP-transmitter leaks at high pressure ("+") side.

Tighten coupling (s) or repair leak.

Air entrapped in sensing lines between Viscotherm sensor and dP-transmitter

Vent sensing lines as described in Section 8.1.

Incorrect zero setting of dP-transmitter.

Adjust zero as described in Section 9.2.

Internal leakages in Viscotherm[®] sensor.

Contact VAF Instruments or nearest service representative for repairs.

10.2 VISCOSITY SIGNAL TOO HIGH

(May be indicated by incorrect temperature of the fuel).

POSSIBLE CAUSE

CORRECTIVE ACTION

Sensing line between Viscotherm[®] sensor and dP-transmitter leaks at low pressure ("-") side.

Tighten coupling(s) or repair leak.

Incorrect zero setting of dP-transmitter.

Adjust zero as described in Section 9.2.

Amplifier unit of dP-transmitter defective.

Contact VAF Instruments or nearest service representative for repair.

Measuring capillary clogged.

Contact VAF Instruments or nearest service representative for repair.

10.3 VISCOSITY SIGNAL REMAINS AT MAXIMUM VALUE

POSSIBLE CAUSE

CORRECTIVE ACTION

Fuel too cold during start-up.

Start system in accordance with chapter 8 and/or heat sensing lines between sensor and dP-transmitter.

Fuel too cold during normal system operation, due to insufficient heating

Increase output signal of viscosity controller to increase heat emission of fuel heater. Consult factory if this does not solve the problem.

DPT malfunctioning.

Contact VAF Instruments or nearest service representative for repair or replacement of DPT.

10.4 NO VISCOSITY SIGNAL

POSSIBLE CAUSE

CORRECTIVE ACTION

Electric motor of Viscotherm[®] sensor not running.

Check mains supply. Does motor have correct voltage? Is motor switch 'on'?

3-phase electric motor of Viscotherm[®] sensor rotates in wrong direction.

Reverse 2 of the 3 leads at terminal strip of motor.

Sensing line(s) between Viscotherm[®] sensor and DPT leaking.

Tighten coupling(s) or repair leaks.

Air trapped in sensing lines after system or instrument rebuild.

Vent sensing lines as described in section 8.1.

Equalising valve (C, figure 9) on DPT is open and/or block valves around Viscotherm[®] sensor are closed.

Ensure that equalising valve is closed and block valves are open.

No electrical supply to DPT.

Supply voltage should be 24 V DC. Check integrity of electrical connections and/or fuses in power supply unit.

DPT malfunctioning.

Contact VAF Instruments or nearest service representative for repair or replacement of DPT.

11. MAINTENANCE RECORD

11.1 LISTING OF MAINTENANCE OPERATIONS

[illegible]

12. PARTS LISTS

12.1 SPARE PARTS KITS

The following spare parts kits for the sensor/differential pressure transmitter assembly are available from VAF Instruments. Refer to section 12.2.1 for the contents of each kit. Refer to section 12.3 for replacement parts of the differential pressure transmitter.

<u>Kit Part No.</u>	<u>Description</u>
---------------------	--------------------

Recommended spare parts for Viscotherm[®] sensor

0390-0085	for 2 year operation, capillary material glass
0390-1116	for 2 year operation, capillary material stainless steel
0390-1117	for 5 year operation, capillary material stainless steel

Recommended spare parts kit 1-phase and 3-phase electric motors, type 'Marbaise'

0390-1157	for 2 year operation
0390-1158	for 5 year operation

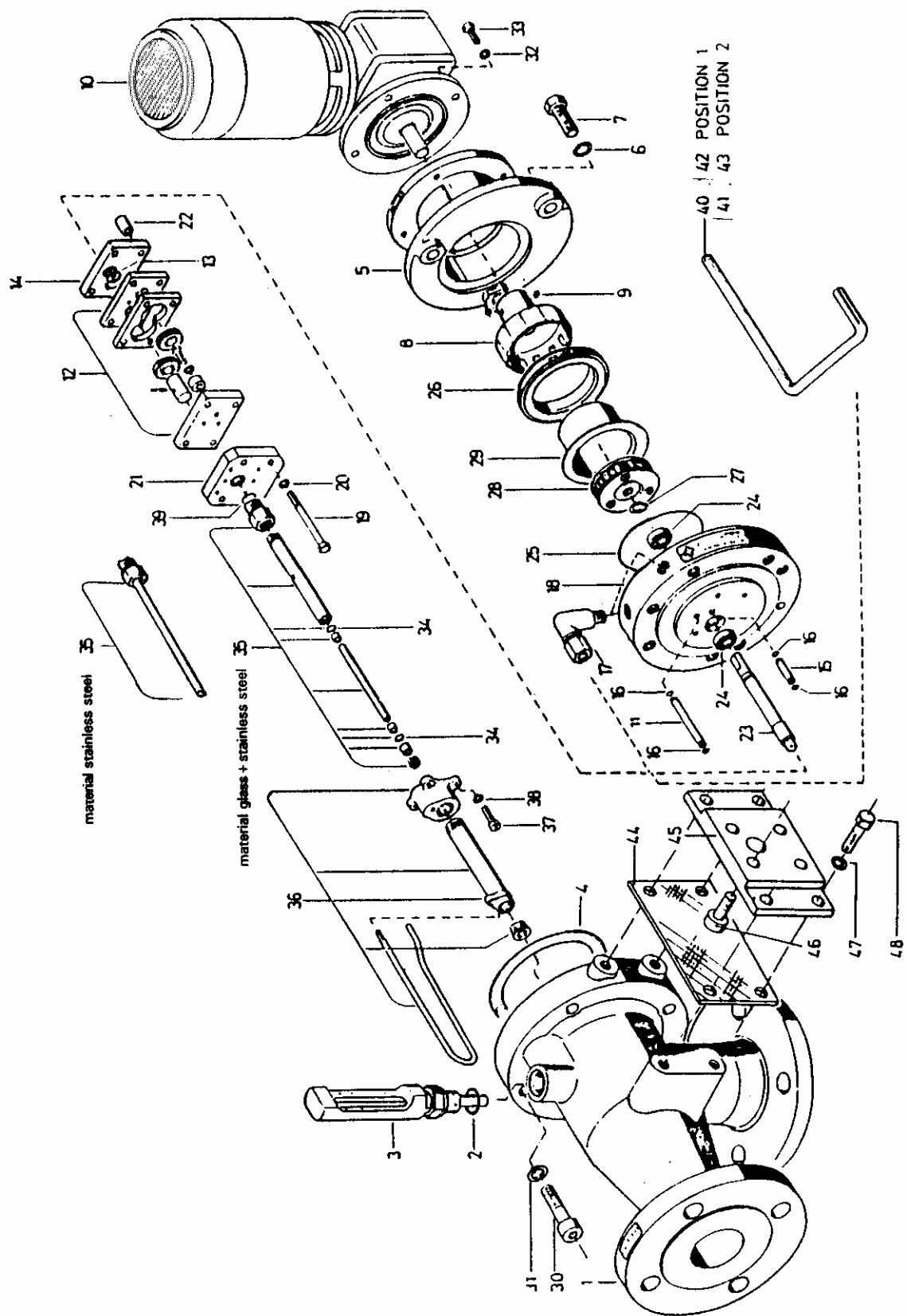


Figure 13, Exploded view of Viscotherm[®] sensor

12.2 VISCOTHERM SENSOR PARTS

Fig. 13
Ref. No

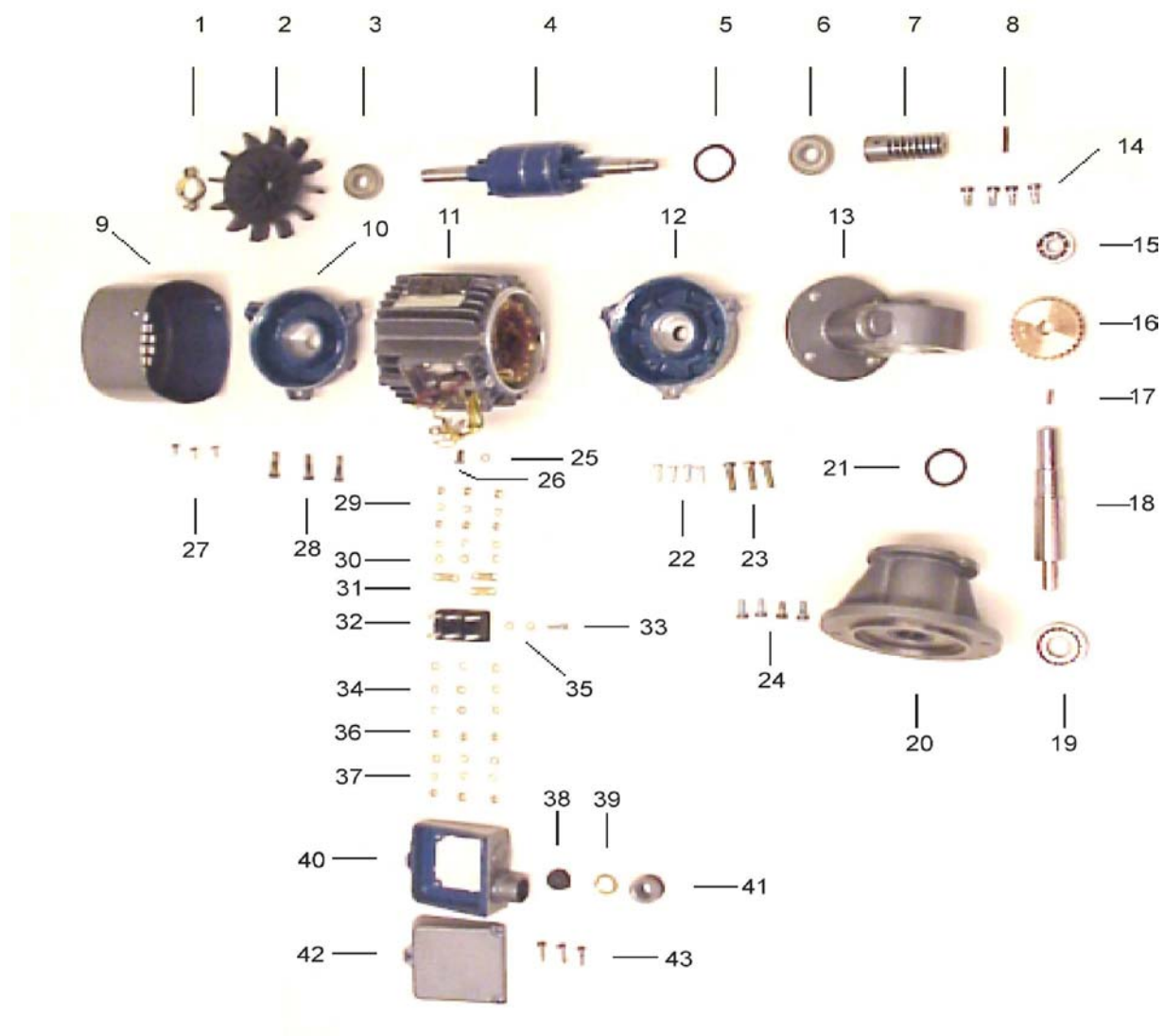
	Part Number	Qty	Part Name and Material
1		1	Housing, steel
	0401-0715		DIN DN 50, PN 10 ... 40 ductile iron
	0401-0511		DIN DN 50, PN 64 steel
	0401-0037		DIN DN 50, PN 100 steel
	0401-0655		DIN DN 65, PN 40 steel
	0401-0716		2" ANSI, 150 lbs ductile iron
	0401-0717		2" ANSI, 300 lbs ductile iron
	0401-0038		2" ANSI, 600 lbs steel
	0401-0718		JIS DN 50, 10K, 50A ductile iron
	0401-0719		JIS DN 50, 16K, 20K, 50A ductile iron
	0401-0642		JIS DN 50, 30K, 50A steel
	0401-0526		JIS DN 50, 10K, 65A steel
	0401-0066		JIS DN 50, 16K, 65A steel
2	0630-3019	1	O-ring, ID 20.35 x Ø 1.78 mm, Viton (T= ≤ 200°C)
	0630-9019	1	O-ring, ID 20.35 x Ø 1.78 mm, Kalrez (T=>200°C)
3	0653-0001	1	Thermometer 0-200°C / 50-400°F (T= ≤ 200°C)
	0653-0056	1	Thermometer 0-300°C / 50-550°F (T=>200°C)
4	0431-0133	1	Packing, main flange, OD 116 x ID 92 x 2 mm, Klinger 100
5	0420-0114	1	Console, motor mounting, ductile iron
6	0718-1200	3	Spring washer, M12, DIN 127, spring steel
7	0733-1240	4	Screw, hex. hd., M12 x 40 mm, DIN 933, steel 8.8
8	0313-0009	1	Outer magnet ass'y
9	0731-0606	2	Set screw, hex. socket, M6 x 6 mm, DIN 916, steel 45H
10		1	Motor, electric, type Marbaise, with gearbox
	0672-0041		220/380, 240/415, 250/440, 277/480 VAC, 50/60 Hz, 3 ph
	0672-0042		220 - 240 VAC, 50/60 Hz, 1 ph
	0672-0043		110 VAC, 50/60 Hz, 1 ph
	0672-0044		110/190 VAC, 50/60 Hz, 3 ph
	0672-0047		110 VDC
	0672-0048		220 VDC
	0672-0049		220/380, 240/415, 250/440, 277/480 VAC, 50/60 Hz, 3 ph, EExe II T3
	0672-0050		110/190 VAC, 50/60 Hz, 3 ph, EExe II T3
11*	0442-0111	1	Pipe piece, OD 6 x ID 3 x 58 mm, steel, (T= ≤ 200°C)
	0442-0024	1	Pipe piece, OD 6 x ID 2 x 58 mm, steel, (T=>200°C)
12*	0671-0001	1	Pump ass'y, stainless steel
13*	0630-6013	1	O-ring, ID 12.00 x Ø1.00 mm, Viton, (T= ≤ 200°C)
	0431-0027	1	Packing ring, OD 14 x ID 11 x 1 mm, Kalrez, (T=>200°C)
14*	0410-0178	1	Plate, pump, 64 x 40 x 10 mm, steel, (T= ≤ 200°C)
	0410-0061	1	Plate, pump, 64 x 40 x 10 mm, steel, (T=>200°C)
*		1	Main flange assembly, consisting of items 11...29

	0314-0020PH		for pressure rating 40 bar, 150 & 300 lbs, 10...20K, (T= ≤ 200°C)
	0314-0021PH		for pressure rating 64 bar, 100 bar, 600 lbs, (T= ≤ 200°C)
	0314-0039PH		(T=>200°C)
15*	0442-0112	1	Pipe, OD 6 x ID 3 x 26 mm, steel, (T= ≤ 200°C)
	0442-0025	1	Pipe, OD 6 x ID 2 x 26 mm, steel, (T=>200°C)
16*	0630-6010	4	O-ring, ID 4.00 x Ø1.00 mm, Viton, (T= ≤ 200°C)
	0630-9006	4	O-ring, ID 2.90 x Ø 1.78 mm, Kalrez, (T=>200°C)
17*	0621-0066	2	Coupling, male elbow, ¼" NPT x 10 mm, steel
18*		1	Main flange, OD 160 x 48 mm, steel
	0414-0016		for pressure rating 40 bar, 150 lbs, 300 lbs, 10K, 16K
	0414-0017		for pressure rating 64 bar, 100 bar, 600 lbs
19*	0732-0670	4	Bolt, hex. hd., M6 x 70 mm, DIN 931, steel 8.8
20*	0718-0600	4	Spring washer, M6, DIN 127, spring steel
21*	0410-0179	1	Plate, pump, 64 x 60 x 11.5 mm, steel
22*	0454-0005	4	Spacer, OD 10 x ID 6 x 15 mm
23*	0404-0030	1	Shaft, pump/magnet, steel
24*	0601-7004	2	Ball bearing, OD 19 x ID 10 x 5 mm, steel
25*	0630-3147	1	O-ring, ID 67.95 x 2.62 mm, Viton, (T= ≤ 200°C)
	0630-9147	1	O-ring, ID 67.95 x 2.62 mm, Kalrez, (T=>200°C)
26*	0417-0001	1	Nut, ring, M85 x 1.5 x ID 58 x 12 mm, steel
27*	0740-0080	1	Ring, retaining, 8 DIN 6799, spring steel
28*	0313-0010	1	Inner magnet ass'y
29*	0409-0091	1	Cap, magnet, AISI-316
30	2728-1250		Capscrew, socket hd., M12 x 50 mm, DIN 912, steel 12.9
		4	for pressure rating 40 bar, 150RF, 300 RF, 10K, 16K
		6	for pressure rating 64 bar, 100 bar, 600 RF
31	0741-1200		Spring washer, M12, DIN 7980, spring steel
		4	for pressure rating 40 bar, 150 lbs, 300 lbs, 10K, 16K
		6	for pressure rating 64 bar, 100 bar, 600 lbs
32	0718-0600	4	Spring washer, M6, DIN 127, spring steel
33	0733-0620	4	Screw, hex. hd., M6 x 20 mm, DIN 933, steel 8.8
34		2	O-ring, ID 3.69 x Ø1.78 mm, (only for glass/stn.stl measuring capillary),
	0630-3007		(T= ≤ 200°C)
	0630-9007		(T=>200°C)
*		1	Main flange assembly, consisting of items 11...29
	0314-0020PH		for pressure rating 40 bar, 150 & 300 lbs, 10...20K, (T= ≤ 200°C)
	0314-0021PH		for pressure rating 64 bar, 100 bar, 600 lbs, (T= ≤ 200°C)
	0314-0039PH		(T=>200°C)
35**		1	Measuring capillary ass'y, calibrated
	0352-0037		0-25/0-50 mPa·s, stainless steel
	0352-0044		0-100 mPa·s, stainless steel
	0352-0031		0-200 mPa·s, glass/stainless steel
	0352-0032		0-500 mPa·s, glass/stainless steel
	0352-0033		0-1000 mPa·s, glass/stainless steel

36		1	Damping capillary ass'y, steel/stainless steel
	0352-0015PH		0-25 and 0-50 mPa·s
	0352-0016PH		0-100 and 0-200 mPa·s
	0352-0017 PH		0-500 and 0-1,000 mPa·s
37	0708-0416	4	Screw, slotted ch.hd., M4 x 16 mm, DIN 84, steel 5.8
38	0741-0400	4	Spring washer, M4, DIN 7980, spring steel
39**	0630-6013	1	O-ring, ID 12.00 x Ø1.00 mm, Viton, (T= ≤ 200°C)
	0431-0027	1	Packing ring, OD 14 x ID 11 x 1 mm, Kalrez, (T=>200°C)
			Tubing, ' + ' side, OD 10 x ID 8 mm, steel,
40	0442-0081	1	mounting position 1, L=143 x 210 x 55 mm
41	0442-0083	1	mounting position 2, L=143 x 318 x 55 mm
			Tubing, ' - ' side, OD 10 x ID 8 mm, steel,
42	0442-0082	1	mounting position 1, L=143 x 300 x 55 mm
43	0442-0084	1	mounting position 2, L=143 x 236 x 55 mm
44	0410-0038	1	Plate, isolating, 150 x 80 x 1.3 mm, Siltemp 84 CH
45	0410-0212	1	Plate, mounting, 150 x 80 x 16 mm, steel
46	0607-0005	4	Capscrew, socket hd., 7/16"-20 UNF x 15 mm, steel
47	0718-1000	4	Spring washer, M10, DIN 127, spring steel
48	0733-1025	4	Screw, hex. hd., M10 x 25 mm, DIN 933, steel 8.8

**When ordering a calibrated measuring capillary assembly the serial number of the sensor and the frequency of the Viscotherm sensor electric motor must be mentioned. O-ring, pos. 39, is also supplied and must be installed when replacing the capillary.

For contents of spare parts kits refer to next page.



		Item no.					
Spare parts kit	Drawing no.	3	5	6	15	19	21
2 years 0390-1157	0872-1210-4				1x	1x	1x
5 years 0390-1158	0872-1211-4	1x	1x	1x	1x	1x	1x

Parts list see drawing 0872-1212-4 sheet 2 of 2

Assembly drawing Marbaise motor 0872-1212-4

DESIGNING CAD ENGINEERING

ITEM No.	QTY	PARTNAME	MATERIAL
1	1	CLAMP FOR FAN Ø20 mm	
2	1	COOLING FAN	
3	1	BALL BEARING, OD 32 x ID 12 x 10mm	STEEL
4	1	ROTOR	
5	1	OIL SEALING	STEEL WITH RUBBER
		3 PHASE MOTOR, OD 24 x ID 12 x 7mm	
		1 PHASE MOTOR, OD 22 x ID 12 x 5mm	
6	1	BALL BEARING, OD 32 x ID 12 x 10mm	STEEL
7	1	WORM	* STEEL
8	1	PIN GROOVED, DIA 3 x 20mm	*
9	1	COVER FOR FAN	
10	1	END SHIELD	
11	1	STATOR	
12	1	MOTOR SHIELD	
13	1	HOUSING, GEARBOX	*
14	4	SCREW, HEX. SOCKET HEAD CAP, M5 x 12mm	* STEEL
15	1	BALL BEARING, OD 35 x ID 17 x 10mm	* STEEL
16	1	WORMWHEEL	* BRONZE
17	1	KEY, 3x3, L = 12mm	* STEEL
18	1	SHAFT	* STEEL
19	1	BALL BEARING, OD 26 x ID 10 x 8mm	* STEEL
20	1	FLANGE	*
21	1	OIL SEALING, OD 30 x ID 17 x 7mm	* STEEL WITH RUBBER
22	4	SCREW, SLOTTED CHEESE HEAD, M4 x 12mm	STEEL
23	3	SCREW, HEX. HEAD, M5 x 20mm	STEEL
24	4	SCREW, HEX. SOCKET HEAD CAP, M5 x 12mm	* STEEL
25	1	SPRING WASHER, M4	SPRING STEEL
26	1	SCREW, M4 x 10mm PHILIPS	STEEL
27	3	SCREW, SLOTTED CHEESE HEAD, M3 x 10mm	STEEL
28	3	SCREW, M5 x 20mm	STEEL
29	6	NUT, HEX., M4	STEEL
30	6	SPRING WASHER, M4	SPRING STEEL
31	3	CONNECTION PLATE	STEEL
32	1	THERMINAL BOARD	
33	1	SCREW, SLOTTED CHEESE HEAD, M4 x 16mm	STEEL
34	6	WASHER, M4	STEEL
35	2	WASHER, M4	STEEL
36	6	NUT, HEX., M4	STEEL
37	6	SPRING WASHER, M4	SPRING STEEL
38	1	SEAL	RUBBER
39	1	WASHER, OD 18 x ID 13 x 2mm	STEEL
40	1	TERMINAL BOX	
41	1	CABLE GLAND M20x1.5, CABLE DIA 6-12mm	
42	1	COVER, THERMINAL BOX	
43	3	SCREW, SLOTTED CHEESE HEAD, M4 x 16mm	STEEL

ASSEMBLY DRAWING 0872-1212-4 SHEET 1 OF 2

ITEMS MARKED "*" ARE PART OF KIT 0390-1225

SHEET 2 OF 2

			DATE : 20-01-1999	 Dordrecht, The Netherlands	
			DRAWN : B.T.		
			CHECKED : B/		
			MATERIAL :		REV. No.
			SEMI MAT. :		A B
B ITEMS KIT 0390-1225			1-02-05	PARTS LIST VISCOTHERM MOTOR MARBAISE	0872-1212-4 PART OF
A ITEM 41 WAS Pg 13.5			16-07-03		
A CABLE DIA 6-12mm ADDED					
No.	DESCRIPTION	DATE	PAR	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.	
REVISIONS					

SENSOR PARTS

Item No.:	2	4	12	13	16	19	20	22	25	27	30	31	34	37	38	39	
-----------	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	--

Viscosity range 0-25, 0-50 and 0-100 mPa·s, capillary material stainless steel

Kit Part No.:

0390-1116 (2 years)	1x	1x	--	1x	4x	--	--	--	2x	1x	1x	--	--	--	--	--	1x
0390-1117 (5 years)	1x	1x	1x	1x	4x	2x	2x	4x	2x	1x	1x	2x	2x	--	2x	2x	1x

Viscosity range 0-200, 0-500 and 0-1000 mPa·s, capillary material glass/stainless steel

0390-0085 (2 years)	1x	1x	--	1x	4x	--	--	--	2x	1x	1x	--	--	2x	--	--	1x
---------------------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

ELECTRIC MOTOR PARTS, TYPE 'MARBAISE'

<u>Kit Part No.:</u>	<u>Qty</u>	<u>Part Number</u>	<u>Part Name and Material</u>
0390-1157 (2 years)	1	0601-6000	Ball bearing, steel
	1	0601-6003	Ball bearing, steel
	1	0634-0012	Oil sealing, gearbox, steel with nitrile rubber
0390-1158(5 years)	1	0601-6000	Ball bearing, steel
	1	0601-6003	Ball bearing, steel
	1	0634-0012	Oil sealing, gearbox, steel with nitrile rubber
	1		Oil sealing, motor, steel with nitrile rubber
		0634-0013	for 3-phase motor
		0634-0014	for 1 phase motor
	2	2601-6201	Ball bearing, motor, steel
0390-1223	FAN-kit		For 0672-0041
0390-1224	FAN-kit		For 0672-0042/43
0390-1225	Reductor		For 0672-0041/42/43
0390-1226	1Ph, 110V		Motor for reductor
0390-1227	1Ph, 230V		Motor for reductor
0390-1228	3Ph, 230/480V		Motor for reductor

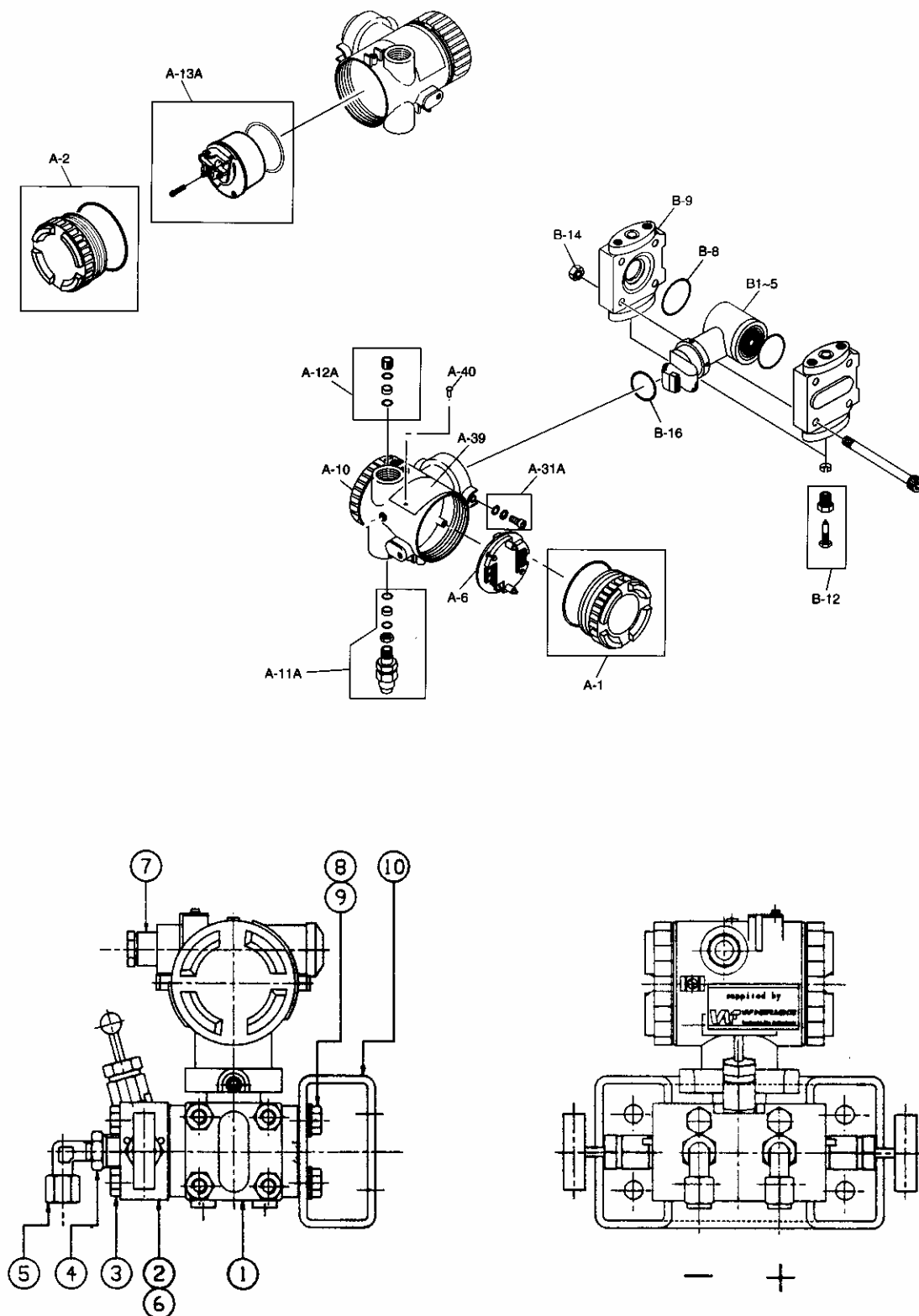


Figure 14, Sectional view of Electronic Differential Pressure Transmitter

12.3 DIFFERENTIAL PRESSURE TRANSMITTER PARTS

Only the parts listed below are available as replacement parts.

<u>Fig. 14 Ref.</u> <u>No.</u>	<u>Part No</u>	<u>Qty</u>	<u>Part Name and Material</u>
-	0399-0246	1	dP/I-transmitter assembly with valve manifold, without mounting bracket
-	0399-0317	1	dP/I-transmitter assembly with valve manifold and mounting bracket
1	0610-0024	1	dP/I-transmitter without valve manifold and mounting bracket, AISI-316 and aluminium
2	0675-0103	1	Valve manifold, AISI-316. Includes items 3 and 6
3	1629-1145	4	Screw, hex. hd., 7/16"-20 UNF, L=1.5", steel 8.8
4	0621-0193	2	Nipple, 1/2" NPT male x 1/4" BSP female, steel
5	0621-0192	2	Male elbow, 1/4" BSPT x Ø 10 mm, steel
6	V010-0026	2	Gasket, Ø 24 x Ø 18 x 3 mm, PTFE
7	0646-1230		Standard, cable dia. 12-14 mm, brass
	0646-1269		Ex-proof EExe II, cable dia. 6 -12 mm
8*	1629-1119	4	Screw, hex. hd., 7/16"-20 UNF, L=0.75", steel 8.8
9*	0799-0057	4	Lockwasher, serrated, M12, AISI-304
10*	0419-0126	1	Mounting bracket, steel

* Only supplied when transmitter is installed separate from sensor

Revision 0405:

1.:4.1:

Viscotherm Sensor: Body material: ductile iron added

2. 9.3.2:

Oil types: Castrol Alphasyn PG 220 added

Revision 0505:

- 1. 4.2 DP/I specifications corrected**
- 2. 6.2.2 cable size changed**
- 3. 9.3.1 corrected and point 4 and 8 changed**
- 4. 12.1 5-years spare kit (glass deleted)**
- 5. 12.2 part numbers “housing” changed to ductile iron
sensor parts: spares for el. motor added**



An der Autobahn 45 ♦ 28876 Oyten ♦ Tel. 04207/91 21-0 ♦ Fax 04207/91 21 41
Email verkauf@ehlersgmbh.de ♦ Home <http://www.ehlersgmbh.com/de>