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iST POWER

INSTALLATION, COMMISSIONING, OPERATION & MAINTENANCE INSTRUCTIONS

POWELL ENGINEERING

RICHBOROUGH

13kV EARTHING TRANSFORMER

DETAILS

MANUAL NUMBER:	**MM0725** **ISSUE 0**
TRANSFORMER SPECIFICATION:	**0105596**
CUSTOMER ORDER NUMBER:	**961412280**
SERIAL NUMBERS:	**103500/1-01** **103500/1-02**

REVISION RECORD

Revision	Change	Author	Date
0	First Issue	R.L.	02/12/2022

SECTION
1

DESCRIPTION

1.1 Preface

The transformer manufactured by **iST POWER Ltd** is supplied as follows:

The earthing transformer is a 3-Phase, outdoor, liquid cooled transformer for 13kV 50Hz 3-Phase supply.

1.2 Technical Description

Type	Mineral Oil cooled Earthing Transformer.
Cooling	ONAN (Nynas Nitro Libra) to IEC 60296
Rated Input Voltage	13 kV (Max 24kV)
Neutral Fault Current	830 A for 3 seconds
Zero Sequence Impedance	27 Ω/Phase (-0% / +20%) (The measured value on test is stamped on the rating and diagram plate).
H.V. Insulation Level	50 / 150 kVp
Frequency	50 Hz
Vector Group	ZN
Phases	3

Input Termination	3 x 52kV 1250A C.R.S. Bushing 250kV P4 Stem: M30 x 2P x 65 Long Located on the H.V. side on the Tank Cover.
Neutral Termination	1 x 52kV 1250A C.R.S. Bushing 250kV P4 Stem: M30 x 2P x 65 Long Located on the Neutral side on the Tank Cover. The bushing is connected to the Neutral Bushing Earth Bar at the bushing stem. Customer requires a M12 connection to be made at the neutral earth point (see Section 6.1 for details).

Fittings	Rating and Diagram Plate Marshalling Box Buchholz Relay Pressure Relief Device Dehydrating Breather Oil Temperature Indicator Winding Temperature Indicator Oil Level Gauge Earthing Terminal Conservator Tank Lifting Lugs Common Skid Base Elevation Frame
Weight of Core and Coils	1707 kg
Liquid Quantity	1142 Litres
Total Weight	3860 kg
	Specification IEC 60076

1.3 Detailed Description

The transformer consists of a 3-Phase coil assembly each mounted on a core assembly.

The coils are wound from insulated copper strip conductor helically wound with ducts for cooling. The coils have been dried out prior to immersion in mineral oil.

The stepped leg/stepped yoke cores are built up from laminations of cold rolled silicon steel. The laminations are interleaved with mitred corners and clamped with fabricated steel frames.

The transformers are contained within a fully welded steel tank with a bolted-on lid. The tank is complete with pressure relief device, drain & filter valves, conservator, Buchholz relay, dehydrating breather, oil and winding temperature indicators and oil level gauge.

The H.V. connections are made onto the cover mounted bushings. The neutral earth connection is made of a M12 connection point at the end of Neutral Earth Bar connected to the Neutral Bushing on the tank cover.

The unit is filled with uninhibited mineral oil. See Appendix A for Product Data Sheet and the Safety Data Sheet.

1.3.1 Transformer Tank and Termination Boxes

The transformer tank is of sheet steel welded construction.

The H.V. lines are on the tank cover suitable for a M30 connection or suitable bushing flag.

The Neutral line is located opposite the H.V. lines. It is suitable for a customer connection at the end of the Neutral Earth Connection Bar with an M12 connection.

1.3.2 Auxiliary Equipment

The transformer is fitted with the following equipment: -

1) Buchholz Relay with alarm and trip contacts.

2) Pressure Relief Device with alarm/trip contacts mounted on the tank side with a duct to direct any expelled oil towards ground level.

3) Oil Temperature Indicator with alarm and trip contact.

4) Winding Temperature Indicator with alarm and trip contact.

5) Oil Level Gauge with minimum level alarm.

Other fittings include removable cable gland plates, oil filter and drain valves. A loose Envirogel dehydrating breather to be fitted on site is included.

SECTION 2

INSTALLATION INSTRUCTIONS

2.1 Introduction

These instructions are intended to give guidance and assistance in the installation and maintenance of the liquid filled 3-Phase earthing transformer.

2.2 Method of Dispatch

Every precaution is taken to ensure that the equipment will arrive at its destination in perfect condition.

The units are dispatched completely assembled, and tested on dedicated road transport.

2.3 Unpacking and Examination Upon Arrival

Immediately upon arrival the equipment should be thoroughly examined externally. Any damage should be reported at once to the Carrier and to **iST POWER Ltd** quoting the Advice Note details to enable a claim to be lodged with the responsible party. Any deficiencies of material should also be notified to the Carrier and to **iST POWER Ltd** immediately.

2.4 Handling

When lifting the equipment use the lifting points, painted yellow, with the correct lifting slings through each lifting point. Great care must be taken not to knock or damage the equipment. Lifting weight of complete unit is 3860kg. Jacking lugs are provided on each side.

2.5 Storage

The unit is suitable for storing outdoors, if required, until commissioned.

2.6 Location

As this equipment is static, the location is of course fixed. Care must be taken to protect the unit from severe environments i.e., pollution from active chemicals, hot air blasting unit or any elements not deemed normal. The unit is dispatched full of oil to operating level sealed for use outdoors with heavy duty paint finish.

2.7 Foundation and Connections

– The equipment must be mounted on a flat level foundation.

– Anti-vibration pads are provided to mount between the transformer base and the concrete plinth. The pads must be arranged as detailed on DWG.010917.

– The H.V. leads are connected to the terminals A4 (red), B4 (yellow), C4 (blue). Refer to Section 6.1 for details and illustrations.

– Neutral connection is made to the ZN terminal at the Neutral Earth Connection (customer's M12 connection). Refer to Section 6.1 for details and illustrations.

– Ensure that an efficient earth connection is made to the earth pad terminals on the tank. Each earth pad is coated with a rust proofing grease, 3M Molykote 111, to provide long term protection against corrosion. If this is removed or damaged during installation, then it should be recoated with the same or similar grease.

– The transformer breather is shipped as a loose item with the transformer. This will be attached to the outside of the transformer or be inside the L.V. switch box. There will also be a copy of the breather fitting instructions.

  To attach the breather, it is necessary to remove the ¾" BSP cap from the end of the breather tube. During transport, a small quantity of oil may find its way into the breather tube. This must be allowed to drain before fitting the breather to prevent the breather material being contaminated. To prevent a spillage of oil, position a 5-litre container beneath the breather tube before removing the end cap. Dispose of any oil in an approved manner.
  Screw the breather onto the end of the breather pipe. The breather must be fitted in accordance with the manufacturer instruction leaflet.

  See Appendix D for the breather details and the fitting instruction leaflet.

SECTION
3

COMMISSIONING INSTRUCTIONS

3.1 General

Check the equipment for any obvious signs of damage, loose items and contamination by water or other substances. Check the oil level.

3.2 Pre-Commissioning Checks

The following electrical tests should be carried out on the equipment.

NOTE **Testing must be carried out by a suitably qualified and experienced test engineer.**

Under no circumstances must any H.V. testing be carried out on the transformer without the H.V. connections being fitted.

Testing without these fittings may result in irreparable damage to the transformer bushings.

3.2.1 Ratio Measurement

Using a proprietary Transformer Ratiometer, check the transformer ratio. Compare the results with the values given in the test certificate.

3.2.2 Resistance Measurement

With the transformer isolated, measure the resistance of the windings. Compare with results in test certificate.

3.2.3 Insulation Resistance Measurement

With the transformer isolated the insulation resistance should be measured.

1. Measured with a 2500V Megger the following are minimum insulation resistance values.
   a) Transformer Windings to Earth 200MΩ.
   b) Primary Winding to Secondary Windings 500MΩ.

2. With a 500V Megger, check the L.V. wiring to earth. The minimum value of resistance should be 10MΩ.

3. Reconnect all leads.

3.3 Buchholz Relay

A Buchholz relay type BS50LA is fitted in the pipework between the conservator and the main tank. This gas detection device is fitted with normally open switches factory set.

See Appendix B for manufacturer details.

3.4 Pressure Relief Device

An auto re-setting pressure relief device is mounted on the main tank lid. It is set to release any pressure built up above 5.8PSI (0.4 atmospheres). A change-over contact indicates operation.

Operation of this device is usually an indication of major failure with the tank.

See Appendix C for manufacturer details.

3.5 De-Hydrating Breather

Desiccant breather charges must be checked on a regular basis in accordance with the manufacturers instructions supplied in this manual. We recommend that the condition of the gel should be checked every 12 months.

Refer to Appendix D for manufacturer details.

3.6 Oil Temperature Indicator

An Oil Temperature Indicator with an alarm and trip switch is fitted to the tank. The temperature setting is of the switches are set at the factory during assembly.

See Appendix E for manufacturer details.

3.7 Winding Temperature Indicator

A Winding Temperature Indicator with an alarm and trip switch is fitted to the tank. The temperature setting is of the switches are set at the factory during assembly.

See Appendix E for manufacturer details.

3.8 Oil Level Gauge

A oil level gauge with a minimum level alarm is fitted to the tank. The setting of the alarm are set at the factory during assembly.

See Appendix F for manufacturer details.

3.9 Paintwork

The exterior paintwork should be inspected, and any damage caused through transport, installation or commissioning should be made good immediately.

The final colour is Roundel Blue to BS 381C Shade 110. The corrosion protected is rated at C3(H)/C4(M) in accordance with ISO 12944 (**iST POWER Ltd** Paint Specification 704-60170).

See Appendix G for details.

SECTION 4

OPERATING INSTRUCTIONS

4.1 Unit Isolation

The transformer has no inherent means of input isolation. The supply to the transformer of 13kV 3-Phase must therefore be isolated remotely and the terminals earthed.

NOTE **Isolate all supplies prior to working on this equipment.**

SECTION 5

MAINTENANCE INSTRUCTIONS

NOTE **Maintenance must only be carried out when the equipment has been totally isolated.**

5.1 Oil Sampling

The insulating liquid is uninhibited mineral oil (Nynas Nitro Libra). See Appendix A for the data sheets. Oil samples should be taken via the sampling valve according to the attached schedule.

Following commissioning, oil samples should be taken at the following intervals: -

a) after 6 months
b) after 12 months
c) after 60 months
d) thereafter every 5 years

The samples should have physical analysis, DGA, water content and breakdown strength measured and recorded for on-going monitoring. Any trend that indicates a deterioration of the transformer should be noted and the frequency of sampling increased as required.

After taking any oil sample, check that the liquid level is correct via the liquid level gauge. Taking a liquid sample will remove 2.5 - 3 litres of oil.

NOTE **Replace or top up with Uninhibited Mineral Oil to IEC 60296.**

5.2 Equipment & Devices

5.2.1 Buchholz Relay

The Buchholz Relay is fitted with set alarm and trip relays. These contacts should be checked every 12 months for correct operation. See Appendix B for manufacturer documents.

5.2.2 Pressure Relief Device

The P.R.D. does not require maintenance during the life of the transformer. However, it is advisable that contacts be checked every 12 months for correct operation of the switch only. See Appendix C for manufacturer documents.

5.2.3 Desiccant Breather

The breather does not require maintenance. However, it will need replacing as the silica gel ages and loses it dehydrating properties. See Appendix D for details and manufacture documents.

5.2.4 Oil Temperature Indicator

The oil temperature indicator does not require maintenance. However, it is advisable to check the contacts to ensure correct operation. See Appendix E for manufacturer documents.

5.2.5 Winding Temperature Indicator

The winding temperature indicator does not require maintenance. However, it is advisable to check the contacts to ensure correct operation. See Appendix E for manufacturer documents.

5.2.6 Oil Level Gauge

The oil level gauge does not require maintenance. However, it is advisable to check the liquid level to ensure correct operation. See Appendix F for manufacturer documents.

5.3 General

The housing of the pressure relief device, marshalling equipment and other equipment should be checked for ingress of water or debris every 12 months and vacuumed/cleaned out as necessary.

The paintwork should be touched up where required.

The transformer liquid level should be checked. The level will be affected by the ambient temperature and the operating load on the transformer.

The whole transformer should be checked for oil leaks.

5.4 Torque Settings

Maximum tightening torque settings for threaded metric **Steel Grade 8.8** nut and bolt. Threads are to be lightly lubricated.

Bolt Size	Approximate Torque (Nm)	
	No Gasket	6mm Gasket
M6	8	5
M8	20	13
M10	40	26
M12	70	45
M16	175	113
M20	341	219

5.5 Spill Management

5.5.1 Personal precautions

Spilt product can constitute a slip hazard. Avoid contact with skin and eyes.

5.5.2 Environmental precautions

In the event of a large spillage, clean as thoroughly as possible and contact local authority. Avoid flushing into drains.

5.5.3 Cleaning procedures

Use an inert absorbent material (e.g. sand, oil absorbent granules, etc.) and place in labelled containers. Product and packaging must be disposed of in accordance with local and national regulations.

5.6 Recommended Spares

Due to the nature of the product, there are very few items that will degrade during the lifespan of the transformer. The only item that will require replacement is the desiccant breather charge. The correct item for the transformer is listed below:

Transformer	Breather Charge
13 kV	Brownell Type R1

The waste parts must be disposed of in a suitable manner in accordance to environmental regulations.

5.7 Disposal

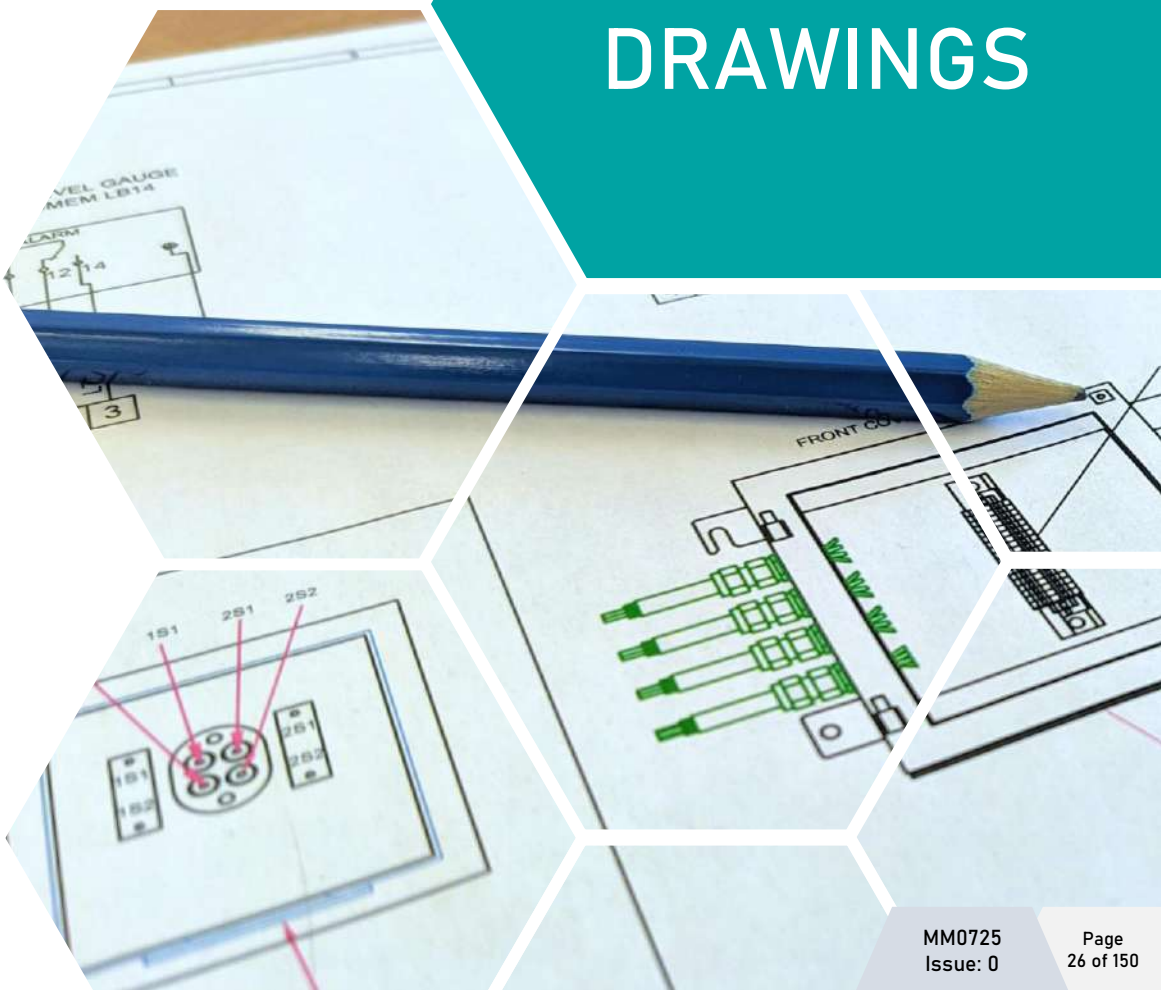
Disposal of this equipment at the end of its operational life must be in accordance with the environmental legislation in force at the time of disposal.

The transformer is constructed in such a way that the different components can easily be recycled at the end of its life span. However, the components can only be recycled after the cooling liquid has been drained. The liquid should be drained and disposed of by a specialist waste contractor in accordance with local regulations.

NOTE **The transformer does not contain any PCBs, PCTs, PCBTs or asbestos material. Consider using the services of a specialist recycling company who have the capacity, skills and knowledge to recycle transformers.**

SECTION 6

LIST OF DRAWINGS



6.1 List of Drawings

Serial Number: 103500/1-01

014975	Outline Drawing
014976	Rating and Diagram Plate
014977	Auxiliary Wiring Diagram
014978	Serial & Nameplate
010917	Anti-Vibration Pads Layout

Serial Number: 103500/1-02

014979	Outline Drawing
014980	Rating and Diagram Plate
014981	Auxiliary Wiring Diagram
014982	Serial & Nameplate
010917	Anti-Vibration Pads Layout

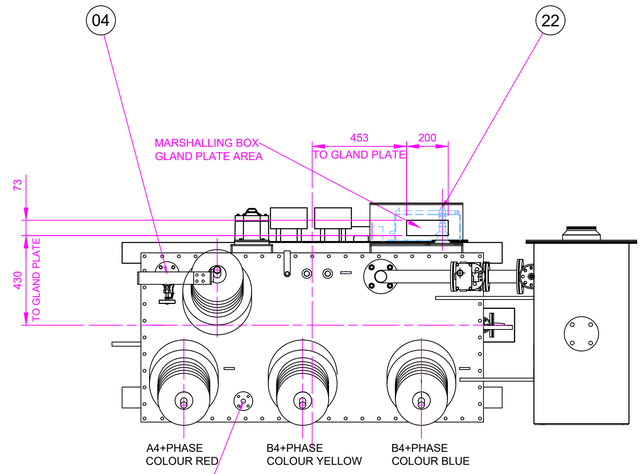
IF IN DOUBT ASK

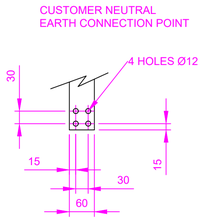
ESTIMATED MASS	kg
CORE & COILS	1707
COMPLETE WITH 1142 LTS OF OIL	3860

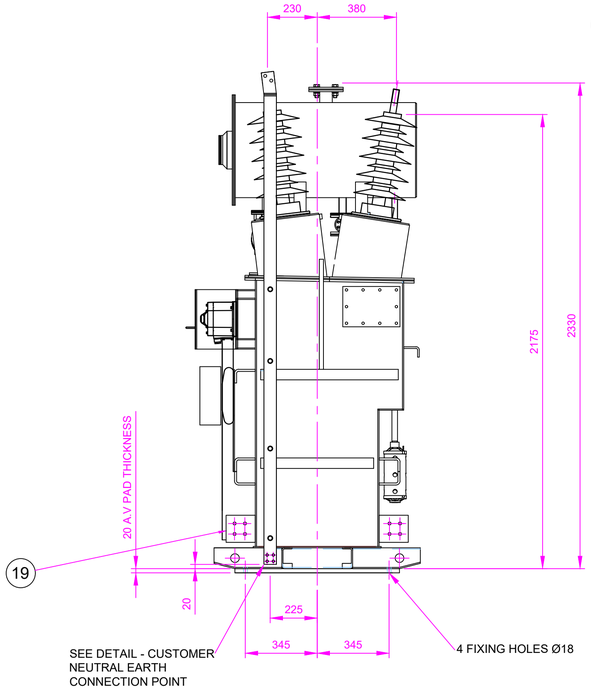
VOLTS	13000
AMPS	830 for 3 secs
VECTOR SYMBOL	ZN
ZSI	27 ohms/phase

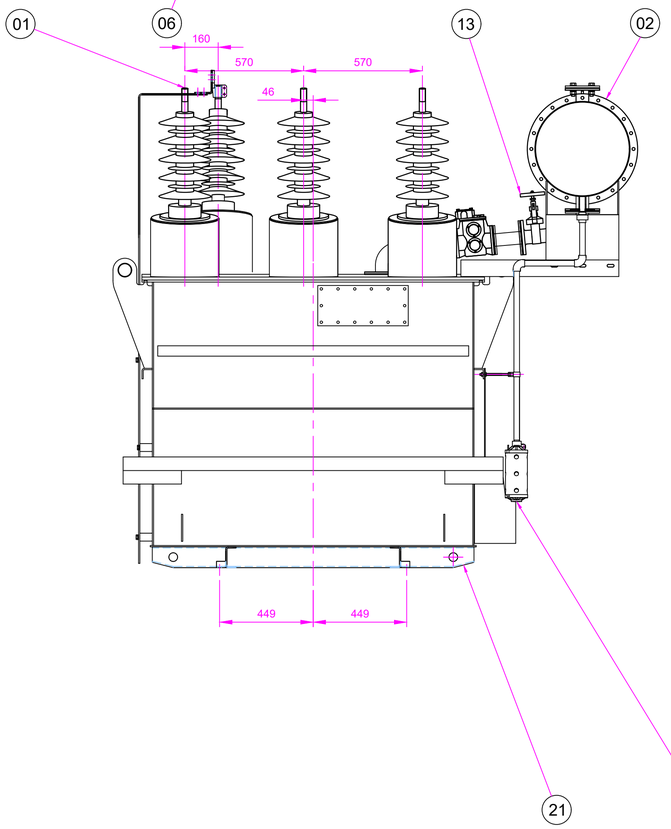
COLOUR: DARK ADMIRALTY GREY TO BS381C SHADE 632

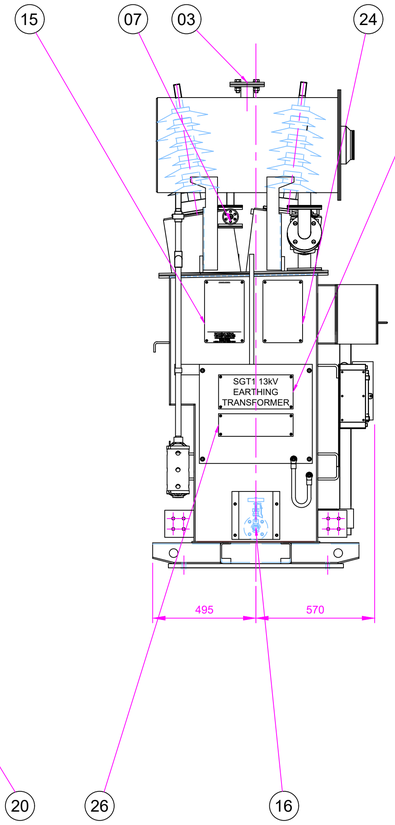
REF	DESCRIPTION
01	LINE AND NEUTRAL H.V. CONNECTION CRS 52/1250A - 250kV P4 - STEM M30 x 2p x 65 LONG
02	CONSERVATOR
03	CONSERVATOR FILLER FLANGE - DN50
04	TOP FILTER VALVE - DN25
05	BUCHHOLZ BLEED AND TEST VALVES
06	THERMOMETER WELL
07	CONSERVATOR DRAIN VALVE - DN25
08	MAIN LIFTERS - 60DIA HOLE
09	COMEM 50M P.R.D WITH OIL DIRECTION DUCT
10	MARSHALLING BOX
11	JACKING POINTS
12	BUCHHOLZ RELAY - DN50
13	CONSERVATOR STOP VALVE - DN50
14	CONSERVATOR REMOVABLE END PLATE - WITH OIL GAUGE.
15	LABEL - RATING AND DIAGRAM PLATE
16	SAMPLING VALVE / DRAIN VALVE - DN25
17	WINDING TEMPERATURE INDICATOR
18	OIL TEMPERATURE INDICATOR
19	EARTH PADS - 4 HOLE 14 DIA
20	ENVIROGEL BREATHER
21	SKID UNDERBASE WITH Ø42 HAULAGE HOLES.
22	CORE EARTH BUSHING.
23	CORE EARTH LABEL.
24	VALVE LOCATION PLATE
25	NAMEPLATE
26	SERIAL No PLATE
27	NEUTRAL BUSHING EARTH BAR

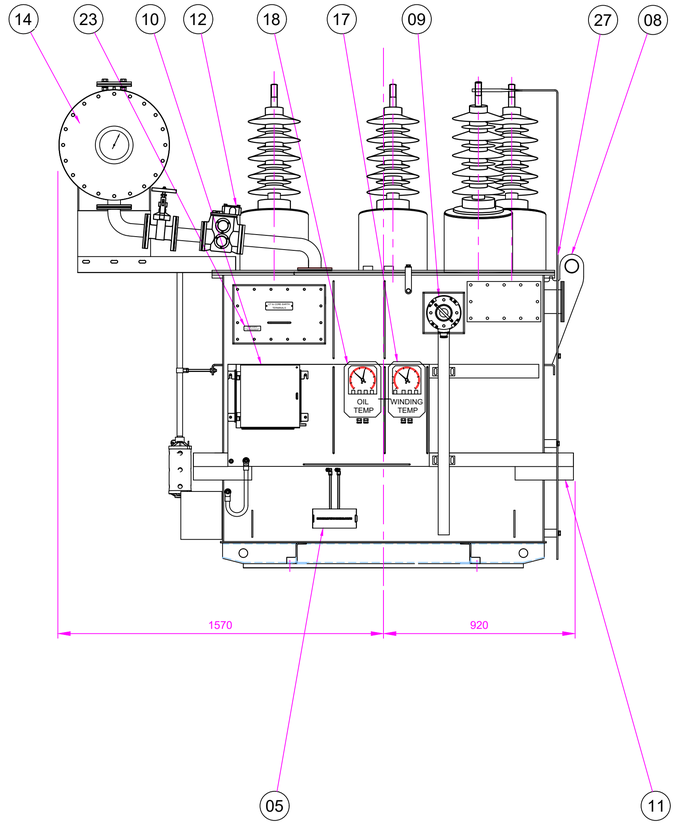












WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A1 594 X 841

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

OUTLINE OF 13kV 830A FOR 3 SEC
EARTHING TRANSFORMER
SERIAL No. 103500/1-01
RICHBOROUGH - SGT1 13kV ET

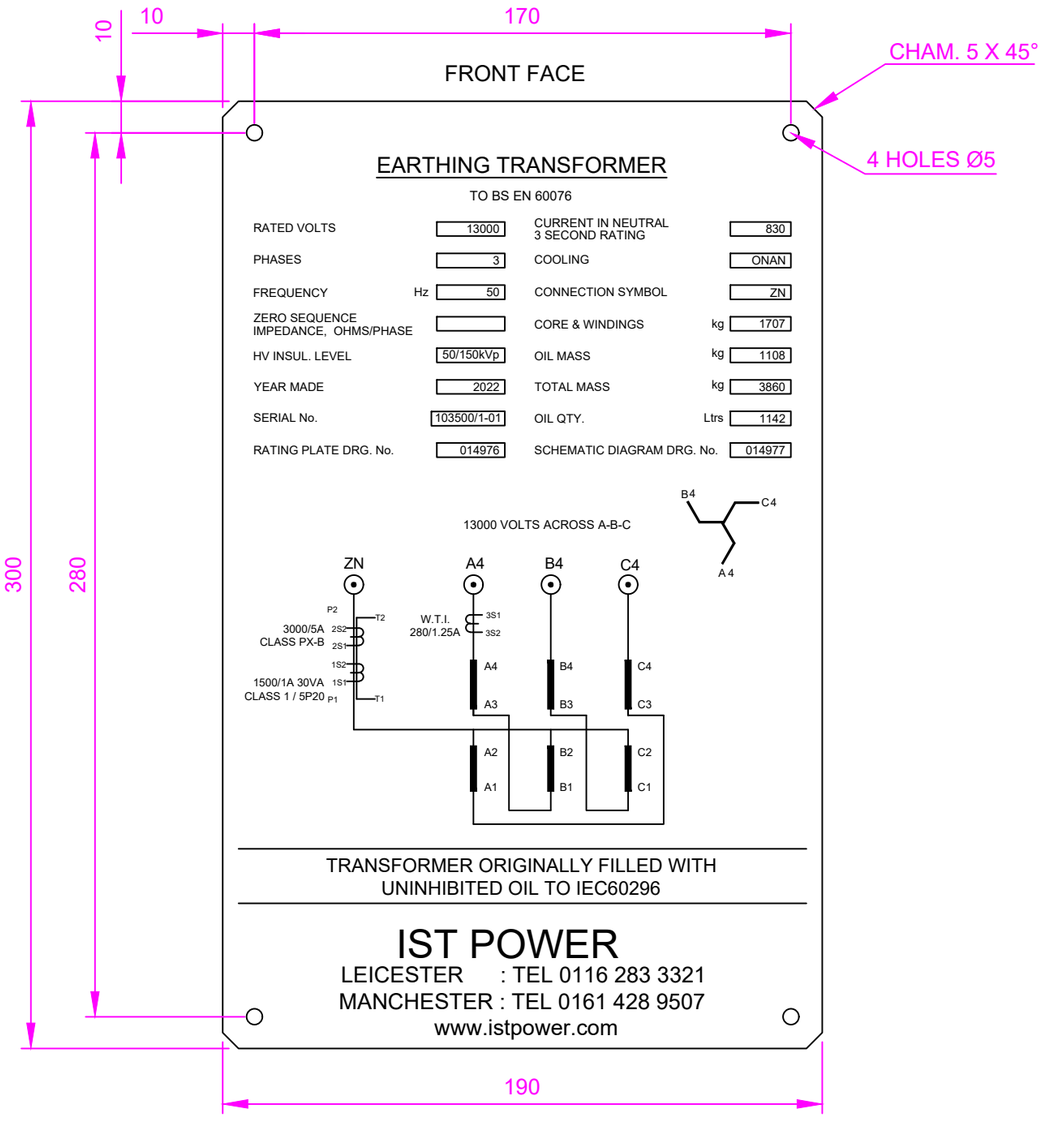
iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
MK	PWJ	1:15	23/09/2022

DRAWING No. 014975

SHEET No. 1

IF IN DOUBT ASK



MATERIAL : 0.8THK STAINLESS STEEL

NOTE : REMOVE ALL SHARP EDGES AND CORNERS

ENGRAVE OR SCREEN PRINT. TO BE SUITABLE FOR HARSH ENVIRONMENT.

ZERO SEQUENCE IMPEDANCE TO BE ENGRAVED AFTER TEST.

ALL LETTERS TO BE BLACK

WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A3 297 X 420

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

RATING AND DIAGRAM PLATE
SERIAL No. 103500/1-01
RICHBOROUGH - SGT1 13kV ET

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

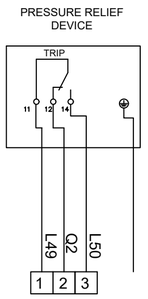
DRAWN	CHECKED	SCALE	DATE
MK	PWJ	1:2	23/09/2022

DRAWING No. 014976

SHEET No. 1

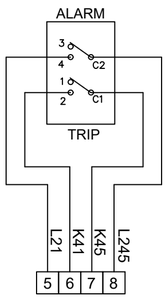
IF IN DOUBT ASK

COMEM 50M



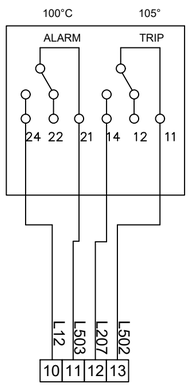
4

BUCHHOLZ RELAY



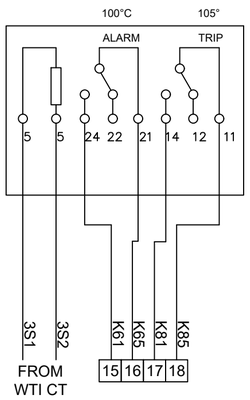
9

OIL TEMP INDICATOR



14

WINDING TEMP INDICATOR



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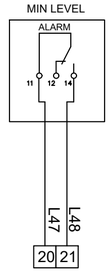
19

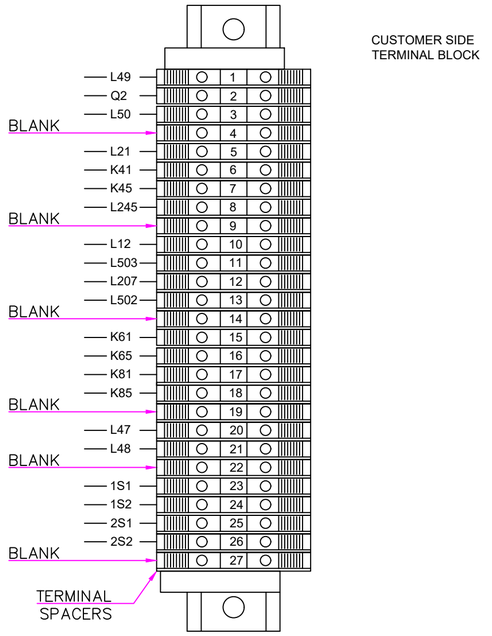
OIL LEVEL GAUGE



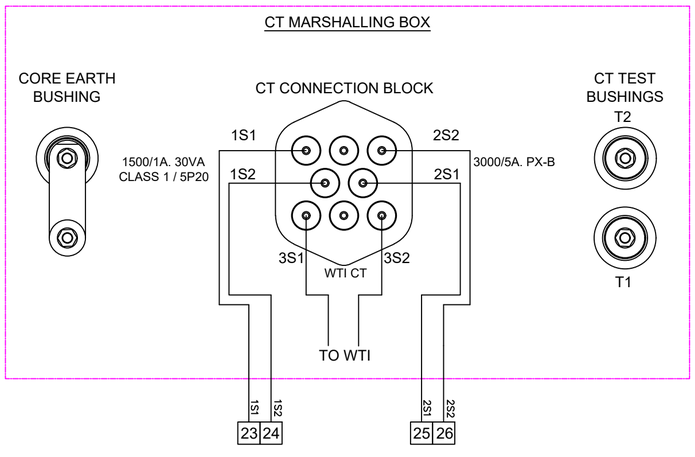
22

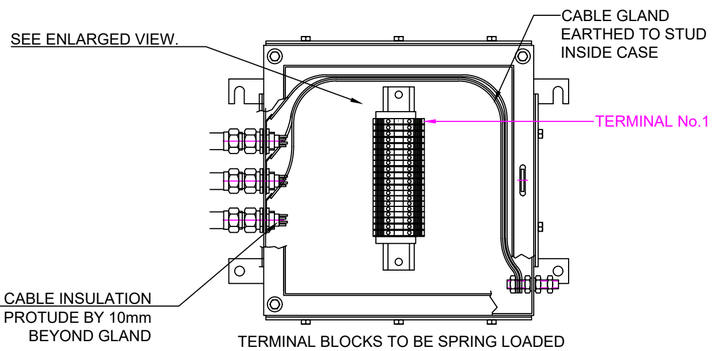
TERMINALS IN MARSHALLING BOX

NOTE : WIRE NUMBERS / FERRULES
ARE FROM THE TERMINALS OUTWARDS



CT MARSHALLING BOX



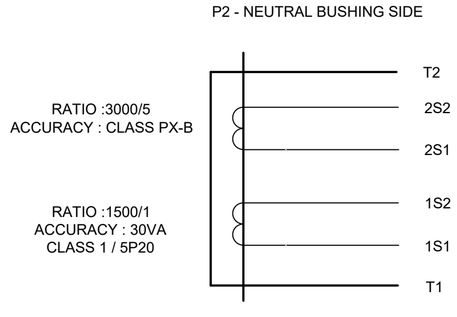


TERMINAL BLOCKS TO BE SPRING LOADED TYPE. WITH HOOK TYPE CABLE TERMINATION.
TERMINAL BLOCKS TO BE NUMBERED
SEE ENLARGED VIEW

2.5mmSQ 4 CORE PVC SWA CABLE

INSTRUMENT	CONTACTS	OPERATION	COMMENTS
PRESSURE RELIEF DEVICE	1 N.O 1 N.C	CLOSES ON EXCESS PRESSURE OPENS ON EXCESS PRESSURE	RELEASE AT 5.8 P.S.I.(40kPa)
BUCHHOLZ RELAY	1 N.O ALARM 1 N.O TRIP	CLOSES ON EXCESS GAS CLOSES ON OIL SURGE	ALARM TRIP
OIL TEMP INDICATOR	1 N.O ALARM 1 N.O TRIP	CLOSES AT 100°C CLOSES AT 105°C	ALARM TRIP
WINDING TEMP INDICATOR	1 N.O ALARM 1 N.O TRIP	CLOSES AT 100°C CLOSES AT 105°C	ALARM TRIP
OIL LEVEL GAUGE	1 N.O ALARM	CLOSES AT MINIMUM LEVEL	ALARM

CT WIRING DIAGRAM



WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A2 420 X 594

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

AUXILIARY WIRING DIAGRAM
SERIAL No. 103500/1-01
RICHBOROUGH - SGT1 13kV ET

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
MK	PWJ	NTS	23/09/2022

DRAWING No. 014977

SHEET No. 1

IF IN DOUBT ASK

010908 REF 01 - SITE NAMEPLATE

010908 REF 02 - SERIAL No NAMEPLATE

MATERIAL - ALL LABELS 1mm THICK
STAINLESS STEEL GRADE 316L
FINISH - NONE
ALL HOLES Ø5
ALL TEXT - BLACK - TWO PACK EPOXY
REMOVE ALL BURRS AND SHARP EDGES
PRINTED FACE TO BE FREE FROM SCRATCHES
USE DRAWINGS AS ARTWORK FOR LABELS

WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A2 420 X 594

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	

TITLE

SERIAL No PLATE & NAMEPLATE
RICHBOROUGH - SGT1
SERIAL No. 103500/1-01

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
MK		1:1	31/10/2022

DRAWING No. 014978

SHEET No. 1

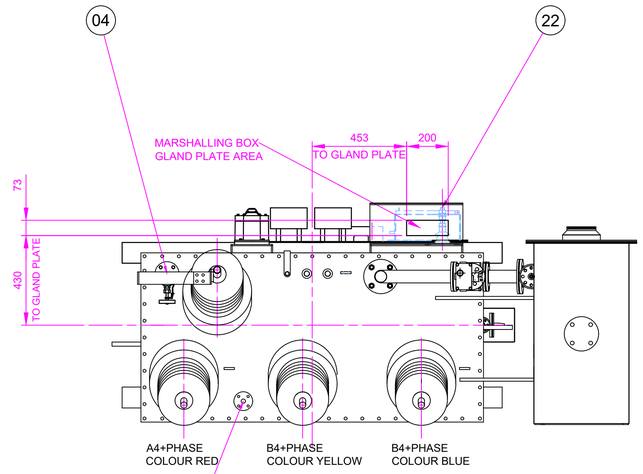
IF IN DOUBT ASK

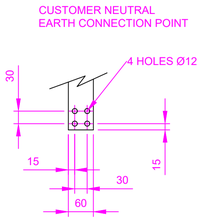
ESTIMATED MASS	kg
CORE & COILS	1707
COMPLETE WITH 1142 LTS OF OIL	3860

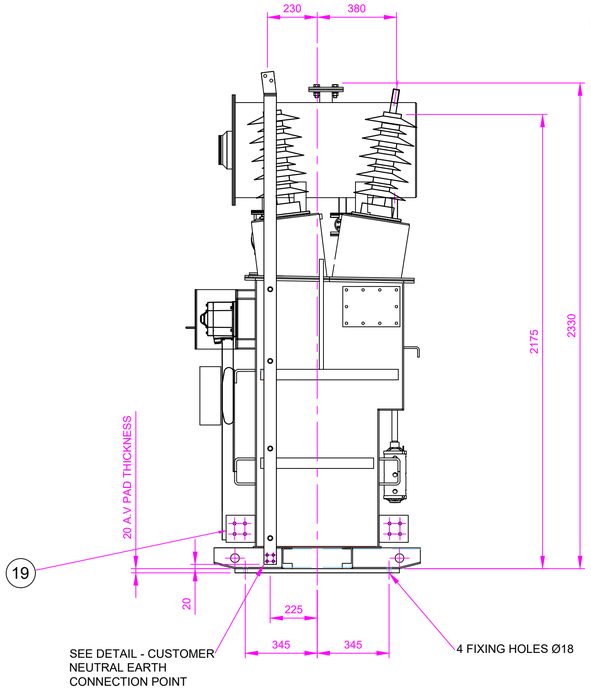
VOLTS	13000
AMPS	830 for 3 secs
VECTOR SYMBOL	ZN
ZSI	27 ohms/phase

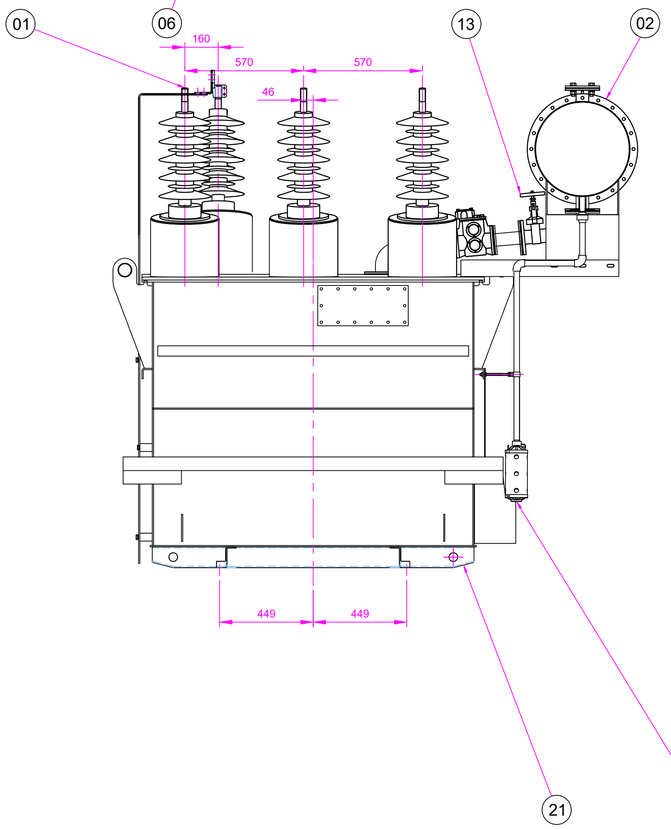
COLOUR: DARK ADMIRALTY GREY TO BS381C SHADE 632

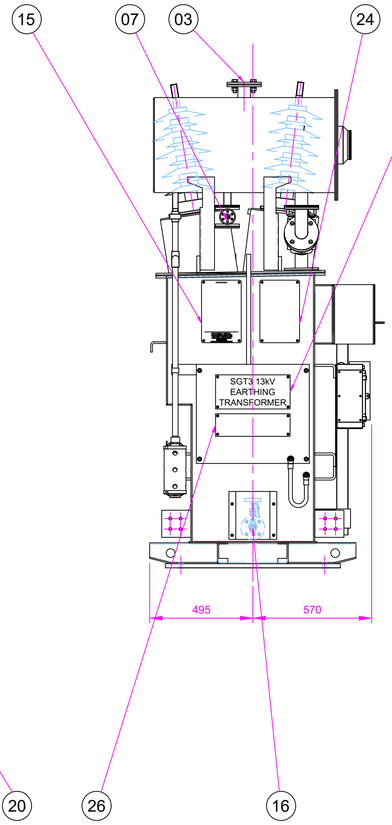
REF	DESCRIPTION
01	LINE AND NEUTRAL H.V. CONNECTION CRS 52/1250A - 250kV P4 - STEM M30 x 2p x 65 LONG
02	CONSERVATOR
03	CONSERVATOR FILLER FLANGE - DN50
04	TOP FILTER VALVE - DN25
05	BUCHHOLZ BLEED AND TEST VALVES
06	THERMOMETER WELL
07	CONSERVATOR DRAIN VALVE - DN25
08	MAIN LIFTERS - 60DIA HOLE
09	COMEM 50M P.R.D WITH OIL DIRECTION DUCT
10	MARSHALLING BOX
11	JACKING POINTS
12	BUCHHOLZ RELAY - DN50
13	CONSERVATOR STOP VALVE - DN50
14	CONSERVATOR REMOVABLE END PLATE - WITH OIL GAUGE.
15	LABEL - RATING AND DIAGRAM PLATE
16	SAMPLING VALVE / DRAIN VALVE - DN25
17	WINDING TEMPERATURE INDICATOR
18	OIL TEMPERATURE INDICATOR
19	EARTH PADS - 4 HOLE 14 DIA
20	ENVIROGEL BREATHER
21	SKID UNDERBASE WITH Ø42 HAULAGE HOLES.
22	CORE EARTH BUSHING.
23	CORE EARTH LABEL.
24	VALVE LOCATION PLATE
25	NAMEPLATE
26	SERIAL No PLATE
27	NEUTRAL BUSHING EARTH BAR

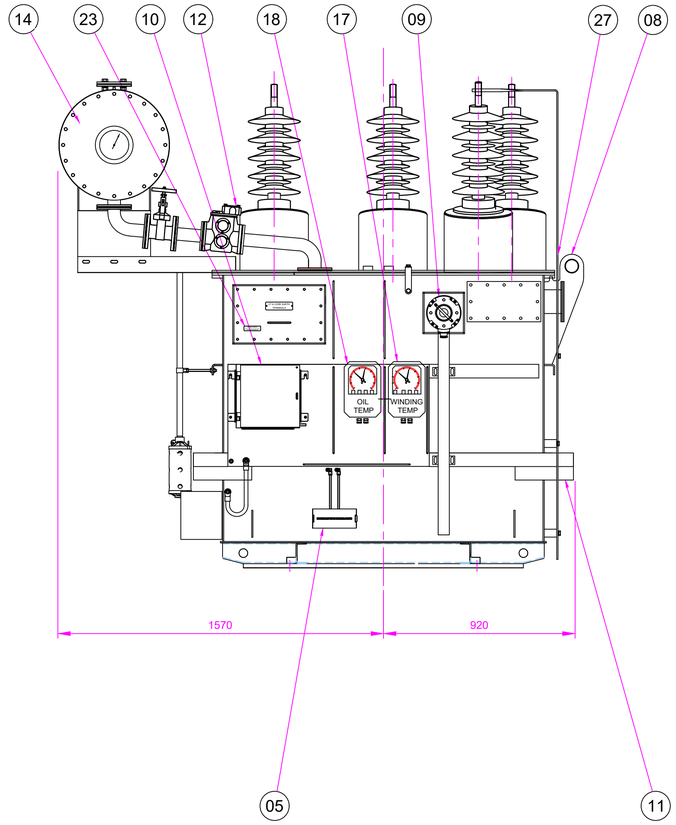












WHERE USED 0105596	TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°	A1 594 X 841

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

OUTLINE OF 13kV 830A FOR 3 SEC
EARTHING TRANSFORMER
SERIAL No. 103500/1-02
RICHBOROUGH - SGT3 13kV ET

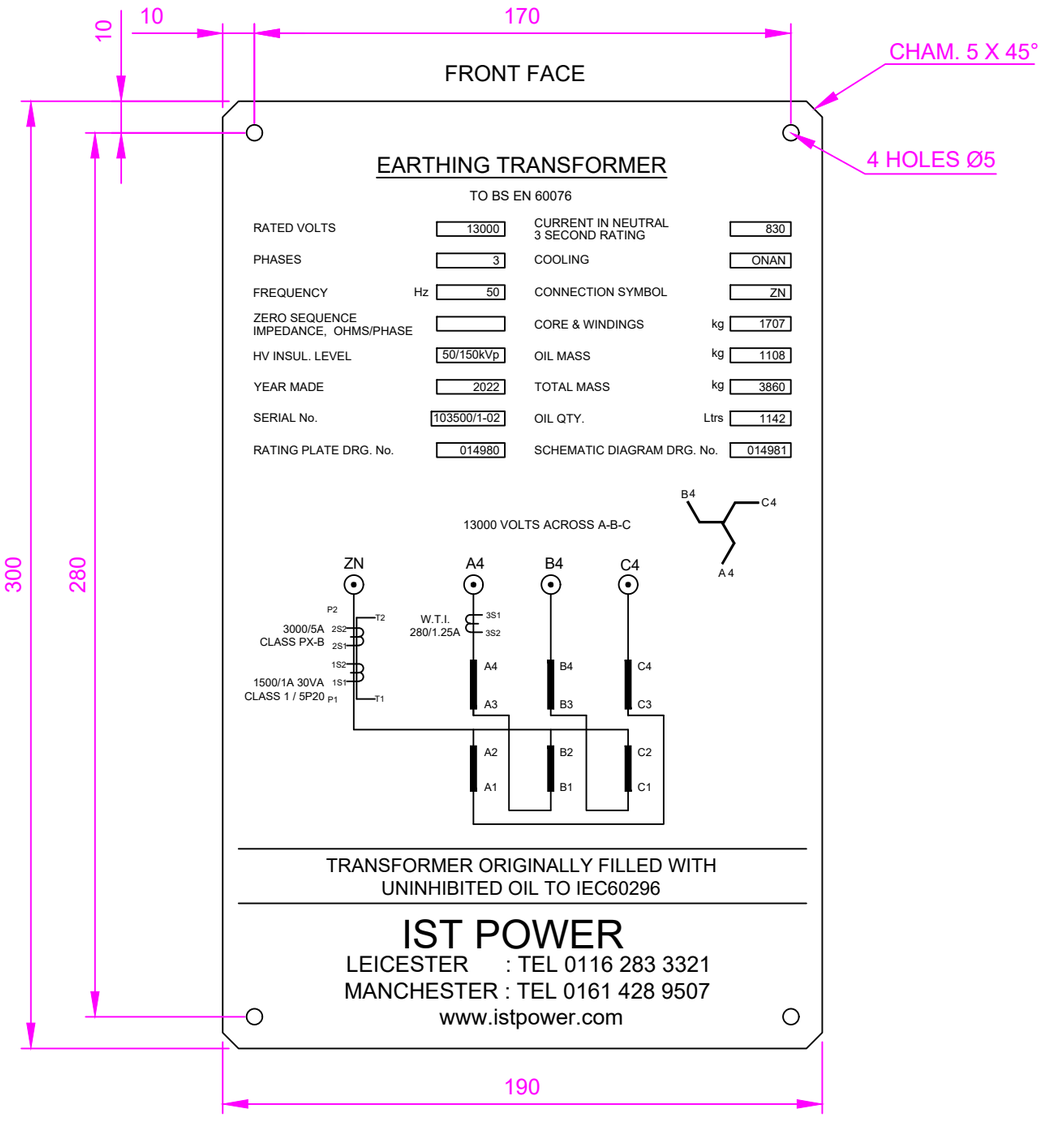
iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
MK	PWJ	1:15	23/09/2022

DRAWING No. 014979

SHEET No. 1

IF IN DOUBT ASK



MATERIAL : 0.8THK STAINLESS STEEL

NOTE : REMOVE ALL SHARP EDGES AND CORNERS

ENGRAVE OR SCREEN PRINT. TO BE SUITABLE FOR HARSH ENVIRONMENT.

ZERO SEQUENCE IMPEDANCE TO BE ENGRAVED AFTER TEST.

ALL LETTERS TO BE BLACK

WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A3 297 X 420

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

RATING AND DIAGRAM PLATE
SERIAL No. 103500/1-02
RICHBOROUGH - SGT3 13kV ET

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

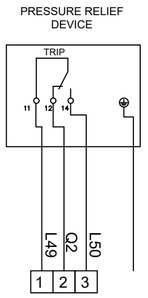
DRAWN	CHECKED	SCALE	DATE
MK	PWJ	1:2	23/09/2022

DRAWING No. 014980

SHEET No. 1

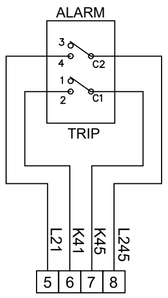
IF IN DOUBT ASK

COMEM 50M



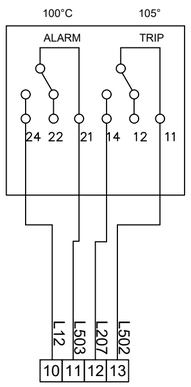
4

BUCHHOLZ RELAY



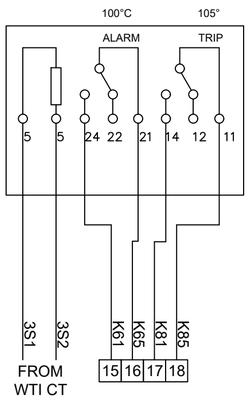
9

OIL TEMP INDICATOR



14

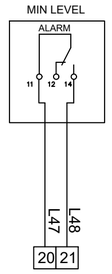
WINDING TEMP INDICATOR



FROM WTI CT

19

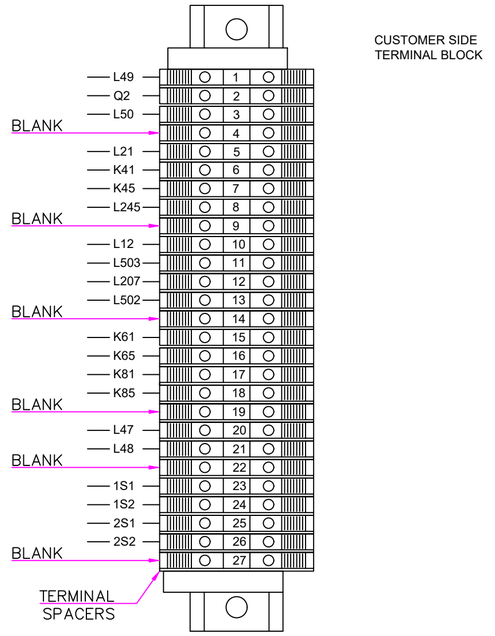
OIL LEVEL GAUGE



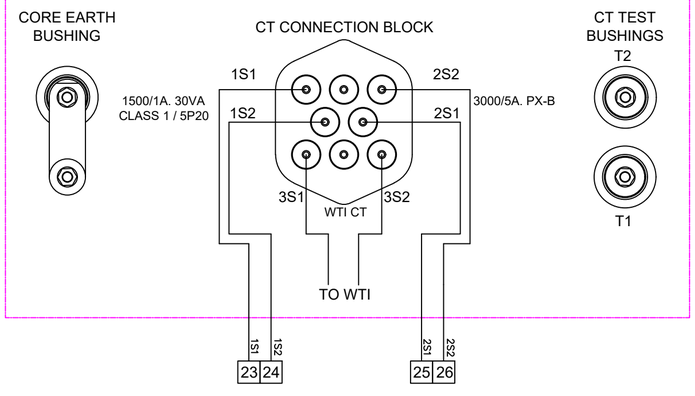
22

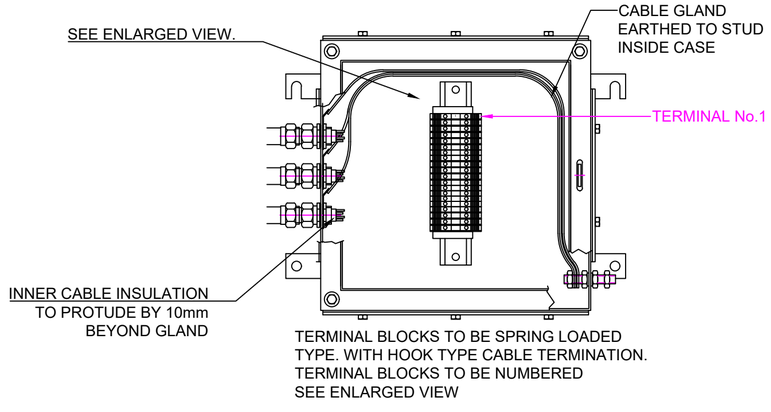
TERMINALS IN MARSHALLING BOX

NOTE : WIRE NUMBERS / FERRULES
ARE FROM THE TERMINALS OUTWARDS



CT MARSHALLING BOX



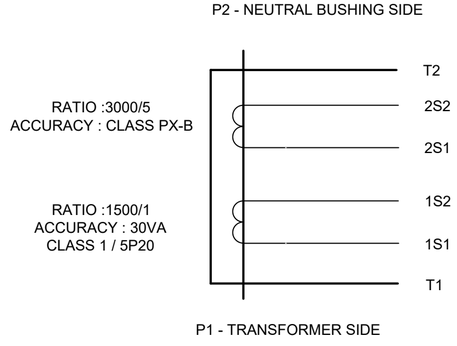


TERMINAL BLOCKS TO BE SPRING LOADED TYPE. WITH HOOK TYPE CABLE TERMINATION.
TERMINAL BLOCKS TO BE NUMBERED
SEE ENLARGED VIEW

2.5mmSQ 4 CORE PVC SWA CABLE

INSTRUMENT	CONTACTS	OPERATION	COMMENTS
PRESSURE RELIEF DEVICE	1 N.O 1 N.C	CLOSES ON EXCESS PRESSURE OPENS ON EXCESS PRESSURE	RELEASE AT 5.8 P.S.I.(40kPa)
BUCHHOLZ RELAY	1 N.O ALARM 1 N.O TRIP	CLOSES ON EXCESS GAS CLOSES ON OIL SURGE	ALARM TRIP
OIL TEMP INDICATOR	1 N.O ALARM 1 N.O TRIP	CLOSES AT 100°C CLOSES AT 105°C	ALARM TRIP
WINDING TEMP INDICATOR	1 N.O ALARM 1 N.O TRIP	CLOSES AT 100°C CLOSES AT 105°C	ALARM TRIP
OIL LEVEL GAUGE	1 N.O ALARM	CLOSES AT MINIMUM LEVEL	ALARM

CT WIRING DIAGRAM



WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A2 420 X 594

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	MK	M2176	SEE ECN	27/09/22

TITLE

AUXILIARY WIRING DIAGRAM
SERIAL No. 103500/1-02
RICHBOROUGH - SGT3 13kV ET

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
MK	PWJ	NTS	23/09/2022

DRAWING No. 014981

SHEET No. 1

IF IN DOUBT ASK

010908 REF 01 - SITE NAMEPLATE

010908 REF 02 - SERIAL No NAMEPLATE

MATERIAL - ALL LABELS 1mm THICK
STAINLESS STEEL GRADE 316L
FINISH - NONE
ALL HOLES Ø5
ALL TEXT - BLACK - TWO PACK EPOXY
REMOVE ALL BURRS AND SHARP EDGES
PRINTED FACE TO BE FREE FROM SCRATCHES
USE DRAWINGS AS ARTWORK FOR LABELS

WHERE USED 0105596

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A2 420 X 594

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	

TITLE

SERIAL No PLATE & NAMEPLATE
RICHBOROUGH - SGT1
SERIAL No. 103500/1-02

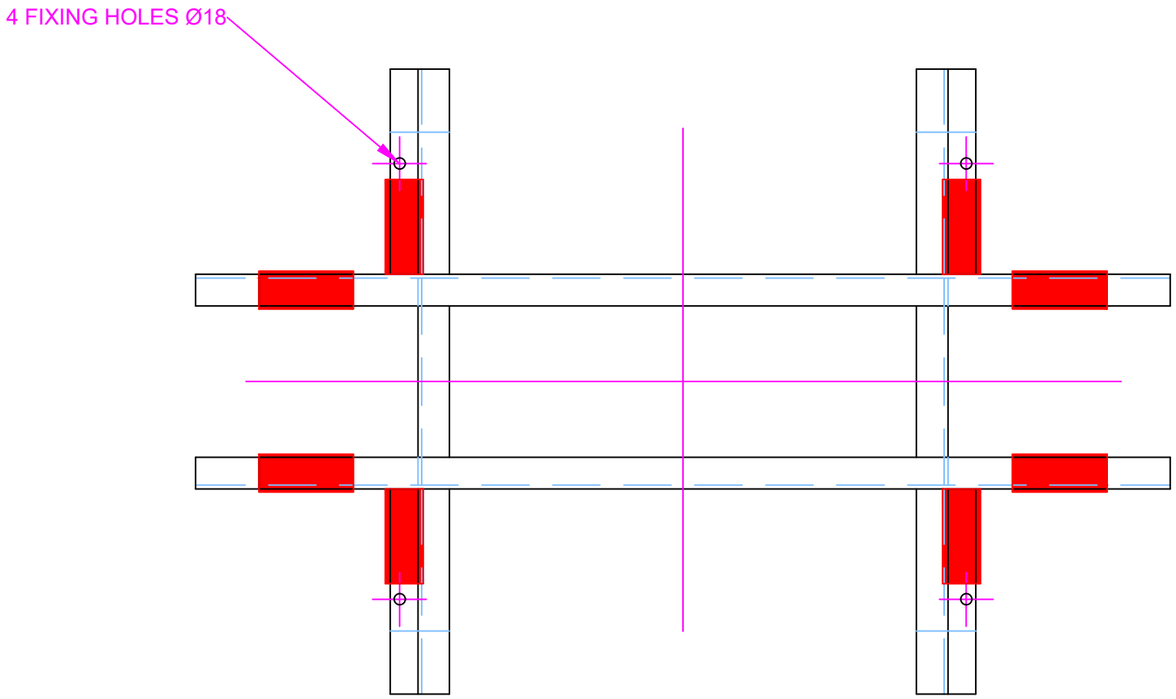
iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

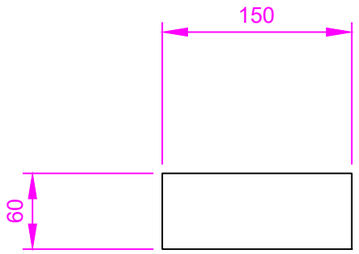
DRAWN	CHECKED	SCALE	DATE
MK		1:1	31/10/2022

DRAWING No. 014982

SHEET No. 1

IF IN DOUBT ASK





PAD DETAIL - QTY 8-off (SCALE 1:5)

MATERIAL - VC6400 20mm THICK

SAB ON ONE SIDE OF THE PADS

WHERE USED T5036

TOLERANCES UNLESS OTHERWISE STATED : NO DECIMAL PLACE ±1mm ONE DECIMAL PLACE ±0.4mm ANGULAR ±1°

A3 297 X 420

ISSUE	BY	ECN	DESCRIPTION	DATE
0			NEW	
1	I.W.	M1326	SEE ECN	07/05/19

TITLE

AV PAD LOCATION & DETAIL

iST POWER
IST Power Ltd.
LEICESTER : 0116 2833321
MANCHESTER : 0161 428 9507

DRAWN	CHECKED	SCALE	DATE
I. WILSON	P.W.J.	1:10	02/05/2019

DRAWING No. 010917

SHEET No. 1

SECTION
7

APPENDIX A

COOLING LIQUID:
NYNAS NITRO LIBRA

(PRODUCT DATA SHEET – 2 PAGES)
(SAFETY DATA SHEET – 22 PAGES)

STANDARD GRADE

Nytro Libra

Electrical insulating oil

Nytro Libra is an uninhibited transformer oil that conforms to IEC 60296 Edition 4.0. Developed and formulated to deliver solid resistance to oil degradation, Nytro Libra provides good oxidation stability thanks to its natural inhibitors. This increases the possibilities for a longer transformer life with less maintenance.

Designed for heavy duty

This product has been specially developed for use in oil-filled electrical equipment – including power and distribution transformers, rectifiers, circuit breakers and switchgears.

Performance and benefits

Good heat transfer. Thanks to low viscosity and viscosity index, this standard grade offers extremely good heat transfer characteristics, ensuring heat is efficiently removed from core and windings.

Reliable oxidation stability. Developed and formulated to deliver good resistance to oil degradation, this grade also provides good oxidation stability for enhanced transformer life and minimum maintenance.

Very good low temperature properties. Naphthenic characteristics allow the transformer to start at the lowest possible temperature – without using pour point depressants.

High dielectric strength. This insulating oil both meets and exceeds the toughest demands on dielectric strength – when stored and handled correctly.

Product description

Nytro Libra fulfils the requirements for IEC 60296 Edition 4.0 uninhibited oil. Nynas classify this product as a standard grade.

Nytro Libra is rigorously analysed and passes the following corrosion tests:
- ASTM D1275
- IEC 62535
- DIN 51353

In accordance with IEC 60296 Edition 4.0, all additives are declared.

There’s more to us than this

We’re delighted you chose one of our transformer oils. If you have any questions about other products and services, get in touch with your local Nynas contact. Besides top quality oils, we offer a wide range of services, including rapid delivery worldwide, sample analysis, training, seminars and much more. All you have to do is ask. Find out more at www.nynas.com

PRODUCT DATA SHEET

Nytro Libra

PROPERTY	UNIT	TEST METHOD	SPECIFICATION LIMITS		TYPICAL DATA
			MIN	MAX	
1 - Function					
Viscosity, 40°C	mm^2/s	ISO 3104		12.0	9.4
Viscosity, -30°C	mm^2/s	ISO 3104		1800	1050
Pour point	°C	ISO 3016		-40	-51
Water content	mg/kg	IEC 60814		30	<20
Breakdown voltage					
- Before treatment	kV	IEC 60156	30		40-60
- After treatment	kV	IEC 60296	70		>70
Density, 20°C	kg/dm^3	ISO 12185		0.895	0.876
DDF at 90°C		IEC 60247		0.005	<0.001
2 - Refining/stability					
Appearance		IEC 60296	Clear, free from sediment		complies
Acidity	mg KOH/g	IEC 62021		0.01	<0.01
Interfacial tension	mN/m	EN 14210	40		47
Corrosive sulphur		DIN 51353	non-corrosive		non-corrosive
Potentially corrosive sulphur		IEC 62535	non-corrosive		non-corrosive
Corrosive sulphur		ASTM D 1275	non-corrosive		non-corrosive
DBDS	mg/kg	IEC 62697-1		not detectable	not detectable
Antioxidant	wt %	IEC 60666		not detectable	not detectable
Metal passivator additives	mg/kg	IEC 60666		not detectable	not detectable
2-Furfural and related compounds content	mg/kg	IEC 61198		0.05	<0.05
Aromatic content	%	IEC 60590			9
3 - Performance					
Oxidation stability at 120°C,164 h		IEC 61125 C			
Total acidity	mg KOH/g			1.2	0.65
Sludge	wt %			0.8	0.16
DDF at 90°C				0.500	0.070
4 - Health, safety and environment (HSE)					
Flash point, PM	°C	ISO 2719	135		150
PCA	wt %	IP 346		3	<3
PCB		IEC 61619	not detectable		not detectable

Nytro Libra is an uninhibited insulating oil, meeting IEC 60296 Ed.4 (2012) General specifications. Breakdown voltage after treatment as per definition given in IEC 60296, section 6.4.

Severely Hydrotreated Insulating Oil
Issuing date: 2017-10-11

NYTRO® LIBRA

SAFETY DATA SHEET

Date of printing	2019-10-21
Date of issue/ Date of revision	2019-10-21
Date of previous issue	2018-11-07
Version	5

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name	NYTRO® LIBRA
Product description	Insulating oil
Product type	Liquid.

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses
Distribution of substance - Industrial Formulation and (re)packing of substances and mixtures - Industrial Use in functional fluids - Industrial Use in functional fluids - Professional

Uses advised against	**Reason**
This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier.	-

1.3 Details of the supplier of the safety data sheet

Supplier/Manufacturer	Head office: Nynas AB P.O. Box 10700 SE-121 29 Stockholm SWEDEN +46 8 602 12 00 (Office hours 8 am - 4.30 pm (CET)) www.nynas.com
e-mail address of person responsible for this SDS	ProductHSE@nynas.com

1.4 Emergency telephone number

Telephone number	+44 (0) 1235 239 670
Hours of operation	24 hour service

National advisory body/Poison Centre

Telephone number 020 - 99 60 00 (Kemiakuten, 24h service)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition: Mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Asp. Tox. 1, H304

The product is classified as hazardous according to Regulation (EC) 1272/2008 as amended.

See Section 16 for the full text of the H statements declared above.

See Section 11 for more detailed information on health effects and symptoms.

SECTION 2: Hazards identification

2.2 Label elements

Hazard pictograms

Signal word	Danger
Hazard statements	H304 - May be fatal if swallowed and enters airways.
Precautionary statements	
Prevention	Not applicable.
Response	P301 + P310 + P331 - IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.
Storage	P405 - Store locked up.
Disposal	P501 - Dispose of contents and container in accordance with all local, regional, national and international regulations.
Supplemental label elements	Not applicable.
Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles	Not applicable.

2.3 Other hazards

Product meets the criteria for PBT or vPvB according to Regulation (EC) No. 1907/2006, Annex XIII	This mixture does not contain any substances that are assessed to be a PBT or a vPvB.
Other hazards which do not result in classification	Prolonged or repeated contact may dry skin and cause irritation.

SECTION 3: Composition/information on ingredients

3.2 Mixtures Mixture

Product/ingredient name	Identifiers	%	Regulation (EC) No. 1272/2008 [CLP]	Type
Distillates (petroleum), hydrotreated light naphthenic	REACH #: 01-2119480375-34 EC: 265-156-6 CAS: 64742-53-6 Index: 649-466-00-2	50 - 70	Asp. Tox. 1, H304	[1] [2]
Distillates (petroleum), hydrotreated light paraffinic	REACH #: 01-2119487077-29 EC: 265-158-7 CAS: 64742-55-8	0 - 50	Asp. Tox. 1, H304	[1] [2]
Distillates (petroleum), hydrotreated heavy paraffinic	REACH #: 01-2119484627-25 EC: 265-157-1 CAS: 64742-54-7 Index: 649-467-00-8	0 - 50	Not classified.	[2]
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	REACH #: 01-2119474878-16 EC: 276-737-9 CAS: 72623-86-0 Index: 649-482-00-X	0 - 50	Asp. Tox. 1, H304	[1] [2]
Distillates (petroleum), solvent-refined heavy naphthenic	REACH #: 01-2119483621-38	0 - 5	Not classified.	[2]

SECTION 3: Composition/information on ingredients

	EC: 265-097-6 CAS: 64741-96-4 Index: 649-457-00-3		**See Section 16 for the full text of the H statements declared above.**	

Regulation (EC) No. 1272/2008 [CLP] Annex VI Nota L applies to the base oil(s) in this product. Nota L - The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3 % DMSO extract as measured by IP 346.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment, are PBTs, vPvBs or Substances of equivalent concern, or have been assigned a workplace exposure limit and hence require reporting in this section.

Type

[1] Substance classified with a health or environmental hazard
[2] Substance with a workplace exposure limit
[3] Substance meets the criteria for PBT according to Regulation (EC) No. 1907/2006, Annex XIII
[4] Substance meets the criteria for vPvB according to Regulation (EC) No. 1907/2006, Annex XIII
[5] Substance of equivalent concern
[6] Additional disclosure due to company policy

Occupational exposure limits, if available, are listed in Section 8.

SECTION 4: First aid measures

4.1 Description of first aid measures

Eye contact	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.
Inhalation	If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If casualty is unconscious and: If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention if adverse health effects persist or are severe. Maintain an open airway.
Skin contact	Wash with soap and water. Remove contaminated clothing and shoes. Handle with care and dispose of in a safe manner. Seek medical attention if skin irritation, swelling or redness develops and persists. Accidental high pressure injection through the skin requires immediate medical attention. Do not wait for symptoms to develop.
Ingestion	Always assume that aspiration has occurred. Do not induce vomiting. Can enter lungs and cause damage. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Seek professional medical attention or send the casualty to a hospital. Do not wait for symptoms to develop. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Before attempting to rescue casualties, isolate area from all potential sources of ignition including disconnecting electrical supply. Ensure adequate ventilation and check that a safe, breathable atmosphere is present before entry into confined spaces.

4.2 Most important symptoms and effects, both acute and delayed

Over-exposure signs/symptoms

Eye contact	Slight irritant

SECTION 4: First aid measures

Inhalation	Inhalation of oil mist or vapours at elevated temperatures may cause respiratory irritation.
Skin contact	Adverse symptoms may include the following: irritation dryness cracking
Ingestion	Adverse symptoms may include the following: Nausea or vomiting. diarrhoea

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician	Due to low viscosity there is a risk of aspiration if the product enters the lungs. Treat symptomatically.
Specific treatments	Always assume that aspiration has occurred.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	Use dry chemical, CO_2, water spray (fog) or foam.
Unsuitable extinguishing media	Do not use direct water jets on the burning product; they could cause splattering and spread the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

5.2 Special hazards arising from the substance or mixture

Hazards from the substance or mixture	In a fire or if heated, a pressure increase will occur and the container may burst. This substance will float and can be reignited on surface water.
Hazardous combustion products	Incomplete combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates, gases, including carbon monoxide, H2S, SOx (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

5.3 Advice for firefighters

Special precautions for fire-fighters	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	Avoid breathing vapour or mist. Keep non-involved personnel away from the area of spillage. Alert emergency personnel. Except in case of small spillages, the feasibility of any actions should always be assessed and advised, if possible, by a trained, competent person in charge of managing the emergency. Stop leak if safe to do so. Avoid direct contact with the product. Stay upwind/keep distance from source. In case of large spillages, alert occupants in downwind areas. Eliminate all ignition sources if safe to do so. Spillages of limited amounts of product, especially in the open air when vapours will be usually quickly dispersed, are dynamic situations, which will presumably limit the exposure to dangerous concentrations. Note : recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this

SECTION 6: Accidental release measures

reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken.

For emergency responders

Small spillages: normal antistatic working clothes are usually adequate.

Large spillages: full body suit of chemically resistant and thermal resistant material should be used. Work gloves providing adequate chemical resistance, specifically to aromatic hydrocarbons. Note : gloves made of PVA are not water-resistant, and are not suitable for emergency use. Safety helmet, antistatic non-skid safety shoes or boots. Goggles and /or face shield, if splashes or contact with eyes is possible or anticipated.

Respiratory protection : A half or full-face respirator with filter(s) for organic vapours (and when applicable for H2S) a Self Contained Breathing Apparatus (SCBA) can be used according to the extent of spill and predictable amount of exposure. If the situation cannot be completely assessed, or if an oxygen deficiency is possible, only SCBA's should be used.

6.2 Environmental precautions

Prevent product from entering sewers, rivers or other bodies of water. If necessary dike the product with dry earth, sand or similar non-combustible materials. In case of soil contamination, remove contaminated soil and treat in accordance with local regulations.

In case of small spillages in closed waters (i.e. ports), contain product with floating barriers or other equipment. Collect spilled product by absorbing with specific floating absorbents.

If possible, large spillages in open waters should be contained with floating barriers or other mechanical means. If this is not possible, control the spreading of the spillage, and collect the product by skimming or other suitable mechanical means. The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

6.3 Methods and material for containment and cleaning up

Small spill

Stop leak if without risk. Absorb spilled product with suitable non-combustible materials.

Large spill

Large spillages may be cautiously covered with foam, if available, to limit vapour cloud formation. Do not use water jet. When inside buildings or confined spaces, ensure adequate ventilation. Transfer collected product and other contaminated materials to suitable containers for recovery or safe disposal. Approach the release from upwind. Contaminated absorbent material may pose the same hazard as the spilt product.

6.4 Reference to other sections

See Section 1 for emergency contact information.
See Section 8 for information on appropriate personal protective equipment.
See Section 13 for additional waste treatment information.

SECTION 7: Handling and storage

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

General information

Obtain special instructions before use. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use and store only outdoors or in a well-ventilated area. Hazard of slipping on spilt product. Avoid release to the environment.

7.1 Precautions for safe handling

Protective measures

Do not ingest. Do not breathe dust/fume/gas/mist/vapours/spray. Avoid contact with eyes, skin and clothing. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use.

Prevent the risk of slipping. Take precautionary measures against static discharge. Avoid splash filling of bulk volumes when handling hot liquid product. Empty containers retain product residue and can be hazardous.

SECTION 7: Handling and storage

	Nota : See Section 8 for information on appropriate personal protective equipment. See section 13 for waste disposal information.
Advice on general occupational hygiene	Ensure that proper housekeeping measures are in place. Contaminated materials should not be allowed to accumulate in the workplaces and should never be kept inside the pockets. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash hands thoroughly after handling. Change contaminated clothes at the end of working shift. See also Section 8 for additional information on hygiene measures.
7.2 Conditions for safe storage, including any incompatibilities	Storage area layout, tank design, equipment and operating procedures must comply with the relevant regional, national or local legislation. Storage installations should be designed with adequate bunds in case of leaks or spills. Cleaning, inspection and maintenance of internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Store separately from oxidising agents. Recommended materials for containers, or container linings use mild steel, stainless steel. Not suitable : Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer. Keep only in the original container or in a suitable container for this kind of product. Keep container tightly closed and sealed until ready for use. Do not store in unlabelled containers. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Empty containers may contain harmful, flammable/combustible or explosive residue or vapours. Do not cut, grind, drill, weld, reuse or dispose of containers unless adequate precautions are taken against these hazards. Store locked up. Protect from sunlight.

7.3 Specific end use(s)

Recommendations	Not available.
Industrial sector specific solutions	Not available.

SECTION 8: Exposure controls/personal protection

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

8.1 Control parameters

Occupational exposure limits

Product/ingredient name	Exposure limit values
Distillates (petroleum), hydrotreated light naphthenic	**Work environment authority Regulation 2018:1 (Sweden, 2/2018).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume
Distillates (petroleum), hydrotreated light paraffinic	**Work environment authority Regulation 2018:1 (Sweden, 2/2018).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume
Distillates (petroleum), hydrotreated heavy paraffinic	**Work environment authority Regulation 2018:1 (Sweden, 2/2018).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	**Work environment authority Regulation 2018:1 (Sweden, 2/2018).**

SECTION 8: Exposure controls/personal protection

	TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume
Distillates (petroleum), solvent-refined heavy naphthenic	**Work environment authority Regulation 2018:1 (Sweden, 2/2018).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume
Oil mist	***[Air contaminant]*** **Work environment authority Regulation 2018:1 (Sweden, 2/2018).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume

Recommended monitoring procedures: If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

Product/ingredient name	Type	Exposure	Value	Population	Effects
Distillate (petroleum), hydrotreated light naphthenic	DNEL	Long term Inhalation	5,58 mg/m³	Workers	Local
Distillates (petroleum), hydrotreated light paraffinic	DNEL	Long term Inhalation	5,58 mg/m³	Workers	Local
Distillate (petroleum), hydrotreated heavy paraffinic	DNEL	Long term Inhalation	5,58 mg/m³	Workers	Local
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	DNEL	Long term Inhalation	5,58 mg/m³	Workers	Local

PNECs

No PNECs available

PNEC Summary: Hydrocarbon Block Method (Petrorisk)

8.2 Exposure controls

Appropriate engineering controls: Mechanical ventilation and local exhaust will reduce exposure via the air. Use oil resistant material in construction of handling equipment. Store under recommended conditions and if heated, temperature control equipment should be used to avoid overheating.

Individual protection measures

Hygiene measures: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Wash contaminated clothing before reuse.

Eye/face protection: Recommended: Safety glasses with side shields.

Skin protection

Hand protection: 4 - 8 hours (breakthrough time): nitrile rubber

Body protection: Wear protective clothing if there is a risk of skin contact. Change contaminated clothes at the end of working shift.

Other skin protection: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

SECTION 8: Exposure controls/personal protection

Respiratory protection	Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.
Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	Liquid.
Colour	Light yellow
Odour	Odourless/Light petroleum.
Odour threshold	Not available.
pH	Not applicable.
Melting point/freezing point	-51°C
Initial boiling point and boiling range	Not available.
Flash point	Closed cup: >140°C [Pensky-Martens.]
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapour pressure (Calculated)	<0,01 kPa [room temperature]
Density	0,88 g/cm³ [15°C]
Solubility(ies)	Insoluble in water.
Partition coefficient: n-octanol/ water	Not available.
Auto-ignition temperature	>200°C
Decomposition temperature	>280°C
Viscosity	Kinematic (40°C): 0,096 cm^2/s (9,6 cSt)
Explosive properties	Not available.
Oxidising properties	Not available.
DMSO extractable compounds for base oil substance(s) according to IP346	< 3%

SECTION 10: Stability and reactivity

10.1 Reactivity	No specific test data related to reactivity available for this product or its ingredients.
10.2 Chemical stability	Stable under normal conditions.
10.3 Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
10.4 Conditions to avoid	Keep away from extreme heat and oxidizing agents. Take precautionary measures against static discharge.
10.5 Incompatible materials	Oxidizing agent

SECTION 10: Stability and reactivity

10.6 Hazardous decomposition products	Incomplete combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates, gases, including carbon monoxide, H2S, SOx (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillates (petroleum), hydrotreated light naphthenic	LC50 Inhalation Dusts and mists	Rat	>5,53 mg/l	4 hours	EMBSI 1988 (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1982(similar material)
Distillates (petroleum), hydrotreated light paraffinic	LC50 Inhalation Dusts and mists	Rat	>5,53 mg/l	4 hours	EMBSI 1988 (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1982(similar material)
Distillates (petroleum), hydrotreated heavy paraffinic	LC50 Inhalation Dusts and mists	Rat	>5,53 mg/l	4 hours	EMBSI 1988 (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1982 (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5,53 mg/l	4 hours	EMBSI 1988 (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1982(similar material)

Conclusion/Summary: Based on available data, the classification criteria are not met.

Acute toxicity estimates

N/A

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Observation	Remarks
Distillates (petroleum), hydrotreated light naphthenic	Skin - Non-irritant to skin.	Rabbit	0 to 1	24 to 72 hours	API 1982(similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0 to 0,11	24 to 72 hours	API 1982(similar material)
Distillates (petroleum), hydrotreated light paraffinic	Skin - Non-irritant to skin.	Rabbit	0 to 1	24 to 72 hours	API 1982(similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0 to 0,11	24 to 72 hours	API 1982(similar material)
Distillates (petroleum), hydrotreated heavy paraffinic	Skin - Non-irritant to skin.	Rabbit	0 to 1	24 to 72 hours	API 1982 (similar material)
	Eyes - Non-irritating to the	Rabbit	0 to 0,11	24 to 72	API 1982 (similar

SECTION 11: Toxicological information

	eyes.			hours	material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Skin - Non-irritant to skin.	Rabbit	0 to 1	24 to 72 hours	API 1982 (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0 to 0,11	24 to 72 hours	API 1982(similar material)

Skin — Based on available data, the classification criteria are not met.

Eyes — Based on available data, the classification criteria are not met.

Respiratory — Based on available data, the classification criteria are not met.

Sensitisation

Product/ingredient name	Route of exposure	Species	Result	Remarks
Distillates (petroleum), hydrotreated light naphthenic	skin	Guinea pig	Not sensitizing	API 1982(similar material)
Distillates (petroleum), hydrotreated light paraffinic	skin	Guinea pig	Not sensitizing	API 1982(similar material)
Distillates (petroleum), hydrotreated heavy paraffinic	skin	Guinea pig	Not sensitizing	API 1982 (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)

Skin — Based on available data, the classification criteria are not met.

Respiratory — Based on available data, the classification criteria are not met.

Mutagenicity

Conclusion/Summary — Based on available data, the classification criteria are not met.

Carcinogenicity

Conclusion/Summary — The base oil(s) in this product is based on an severely hydrotreated distillate. The product should not be regarded as a carcinogen.

Reproductive toxicity

Conclusion/Summary — Based on available data, the classification criteria are not met.

Teratogenicity

Conclusion/Summary — Based on available data, the classification criteria are not met.

Aspiration hazard

Product/ingredient name	Result
Distillates (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1
Distillates (petroleum), hydrotreated light paraffinic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
Distillate (petroleum), hydrotreated light naphthenic	Sub-chronic LOAEL Oral	Rat	125 mg/kg	-
	Sub-chronic NOAEL Dermal	Rat	>2000 mg/kg	-
	Sub-acute NOEL Inhalation Dusts and mists	Rat	220 mg/m³	6 hours; 5 days per week
Distillates (petroleum), hydrotreated light paraffinic	Sub-chronic LOAEL Oral	Rat	125 mg/kg	-
	Sub-chronic NOAEL Dermal	Rat	>2000 mg/kg	-
	Sub-acute NOEL Inhalation Dusts and mists	Rat	220 mg/m³	6 hours; 5 days per week

SECTION 11: Toxicological information

Distillate (petroleum), hydrotreated heavy paraffinic	Sub-chronic LOAEL Oral	Rat	125 mg/kg	-
	Sub-chronic NOAEL Dermal	Rat	>2000 mg/kg	-
	Sub-acute NOEL Inhalation Dusts and mists	Rat	220 mg/m³	6 hours; 5 days per week
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Sub-chronic LOAEL Oral	Rabbit	125 mg/kg	-
	Sub-chronic NOAEL Dermal	Rat	>2000 mg/kg	-
	Sub-chronic NOEL Inhalation Dusts and mists	Rat	220 mg/m³	6 hours; 5 days per week

Specific hazard

Aspiration hazard
Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract.
Aspiration of hydrocarbon substances can result in in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death.
This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage.
Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties.

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Distillates (petroleum), hydrotreated light naphthenic	Acute EL50 >10000 mg/l	Daphnia	48 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l Fresh water	Daphnia	21 days
Distillates (petroleum), hydrotreated light paraffinic	Acute EL50 >10000 mg/l	Daphnia	48 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l Fresh water	Daphnia	21 days
Distillates (petroleum), hydrotreated heavy paraffinic	Acute EL50 >1000 mg/l	Daphnia	48 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l Fresh water	Daphnia	21 days
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Acute EL50 >10000 mg/l	Daphnia	48 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l Fresh water	Daphnia	21 days

Conclusion/Summary: Based on available data, the classification criteria are not met.

12.2 Persistence and degradability

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Distillates (petroleum), hydrotreated light naphthenic	-	-	Inherent
Distillates (petroleum), hydrotreated light paraffinic	-	-	Inherent
Distillates (petroleum), hydrotreated heavy paraffinic	-	-	Inherent
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	-	-	Inherent

Conclusion/Summary: Inherently biodegradable.

SECTION 12: Ecological information

12.3 Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Distillates (petroleum), hydrotreated light naphthenic	2 to 6	<500	low
Distillates (petroleum), hydrotreated light paraffinic	2 to 6	<500	low
Distillates (petroleum), hydrotreated heavy paraffinic	2 to 6	<500	low
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	2 to 6	<500	low

Conclusion/Summary: The product has a potential to bioaccumulate.

12.4 Mobility in soil

Mobility: High mobility in soil predicted, based on log Kow > 3.0.

12.5 Results of PBT and vPvB assessment

This mixture does not contain any substances that are assessed to be a PBT or a vPvB.

12.6 Other adverse effects: Insoluble in water. Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

SECTION 13: Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

13.1 Waste treatment methods

Product

Methods of disposal: Where possible (e.g. in the absence of relevant contamination), recycling of used substance is feasible and recommended. This substance can be burned or incinerated, subject to national/local authorizations, relevant contamination limits, safety regulations and air quality legislation. Contaminated or waste substance (not directly recyclable): Disposal can be carried out directly, or by delivery to qualified waste handlers. National legislation may identify a specific organization, and/or prescribe composition limits and methods for recovery or disposal.

Hazardous waste: Yes.

European waste catalogue (EWC)

Waste code	Waste designation
13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils

Packaging

Methods of disposal: The generation of waste should be avoided or minimised wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

SECTION 14: Transport information

International transport regulations

SECTION 14: Transport information

	ADR/RID	ADN	IMO/IMDG Classification	ICAO/IATA Classification
14.1 UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
14.2 UN proper shipping name	-	-	-	-
14.3 Transport hazard class(es)	-	-	-	-
14.4 Packing group	-	-	-	-
14.5 Environmental hazards	No.	No.	No.	No.

14.6 Special precautions for user **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

14.7 MARPOL Annex 1 Oils

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

None of the components are listed.

Substances of very high concern

None of the components are listed.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles: Not applicable.

Other EU regulations

Industrial emissions (integrated pollution prevention and control) - Air: Not listed

Industrial emissions (integrated pollution prevention and control) - Water: Not listed

Ozone depleting substances (1005/2009/EU)

Not listed.

Prior Informed Consent (PIC) (649/2012/EU)

Not listed.

Seveso Directive

This product is not controlled under the Seveso Directive.

National inventory

Australia: All components are listed or exempted.

Canada: All components are listed or exempted.

SECTION 15: Regulatory information

China	All components are listed or exempted.
Japan	**Japan inventory (ENCS)**: Not determined. **Japan inventory (ISHL)**: All components are listed or exempted.
New Zealand	All components are listed or exempted.
Philippines	All components are listed or exempted.
Republic of Korea	All components are listed or exempted.
Taiwan	All components are listed or exempted.
United States	All components are listed or exempted.
Thailand	Not determined.
Turkey	All components are listed or exempted.
Viet Nam	Not determined.

15.2 Chemical safety assessment: Complete.

SECTION 16: Other information

Revision comments: Not available.

Indicates information that has changed from previously issued version.

Abbreviations and acronyms:

ATE = Acute Toxicity Estimate
CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
DMEL = Derived Minimal Effect Level
DNEL = Derived No Effect Level
EUH statement = CLP-specific Hazard statement
N/A = Not available
PBT = Persistent, Bioaccumulative and Toxic
PNEC = Predicted No Effect Concentration
RRN = REACH Registration Number
SGG = Segregation Group
vPvB = Very Persistent and Very Bioaccumulative

Procedure used to derive the classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Classification	Justification
Asp. Tox. 1, H304	Calculation method

Sweden

Full text of abbreviated H statements	H304	May be fatal if swallowed and enters airways.
Full text of classifications [CLP/GHS]	Asp. Tox. 1, H304	ASPIRATION HAZARD - Category 1

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Notice to reader

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Section 1 - Title

Short title of the exposure scenario	Distribution of substance - Industrial
List of use descriptors	**Identified use name:** Distribution of substance - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC09, PROC15 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04, ERC05, ERC06a, ERC06b, ERC06c, ERC06d, ERC07, ESVOC SpERC 1.1b.v1
Environmental contributing scenarios	**Use of non-reactive processing aid at industrial site (no inclusion into or onto article) -** ERC04 **Use of reactive processing aid at industrial site (no inclusion into or onto article) -** ERC06b **Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article) -** ERC06c **Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) -** ERC06d **Use of functional fluid at industrial site -** ERC07 **Use of intermediate -** ERC06a **Use at industrial site leading to inclusion into/onto article -** ERC05
Health Contributing scenarios	**General exposures (open systems) -** PROC04 **General exposures (closed systems) -** PROC01, PROC02, PROC03 **With sample collection -** PROC03 **Laboratory activities -** PROC15 **Bulk transfers -** PROC08b **Drum and small package filling -** PROC09 **Clean-down and maintenance of equipment -** PROC08a **Storage -** PROC01, PROC02
Industry Association	Concawe - 2017
Processes and activities covered by the exposure scenario	Bulk loading (including marine vessel/barge, rail/road car and IBC loading) of substance within closed or contained systems, including incidental exposures during its sampling, storage, unloading, maintenance and associated laboratory activities.

Section 2 - Exposure controls

2.1 Control of environmental exposure

Amounts used	Annual site tonnage (tonnes/year)28 Maximum daily site tonnage (kg/day) 1400
Frequency and duration of use	Continuous release Emission days (days per year) 20
Other conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM) 0.0001 Release fraction to wastewater from process (initial release prior to RMM) 1.0E-7 Release fraction to soil from process (initial release prior to RMM) 1.0E-5
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Air	Treat air emissions. (%) 90
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.

Section 2 - Exposure controls

Conditions and measures related to sewage treatment plant	Estimated substance removal from wastewater via domestic sewage treatment (%) 94,2 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs (%) 94,2 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal (kg/day) 45000 Assumed on-site sewage treatment plant flow (m^3/d) 2000

2.2 Control of worker exposure

General measures applicable to all activities

Concentration of substance in mixture or article	Covers percentage substance in the product up to 100 %.
Frequency and duration of use	Covers daily exposures up to 8 hours
Other conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented Assumes use at not more than 20°C above ambient temperature. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Risk management measures (RMM)

Clean-down and maintenance of equipment - PROC 8a
Drain down system prior to equipment break-in or maintenance.

Storage - PROC 1 & 2
Store substance within a closed system.

Section 3 - Exposure estimation and reference to its source

3.1 Environment

Exposure assessment (environment):	The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model. Risk Characterisation Ratio (RCR) air 0.009 Risk Characterisation Ratio (RCR) water 0.077

3.2 Workers

Exposure assessment (human):	Qualitative approach used to conclude safe use.
Exposure estimation and reference to its source	A DNEL (derived no effect levels) cannot be derived. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Section 1 - Title

Short title of the exposure scenario	Formulation and (re)packing of substances and mixtures - Industrial
List of use descriptors	**Identified use name:** Formulation and (re)packing of substances and mixtures - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC14, PROC15 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC02, ESVOC SpERC 2.2.v1
Environmental contributing scenarios	**Formulation into mixture -** ERC02
Health Contributing scenarios	**General exposures (open systems) -** PROC04 **General exposures (closed systems) -** PROC01, PROC02, PROC03 **Batch processes at elevated temperatures -** PROC03 **With sample collection -** PROC03 **Laboratory activities -** PROC15 **Bulk transfers -** PROC08b **Mixing operations (open systems) -** PROC05 **Transfer from/pouring from containers -** PROC08a **Drum/batch transfers -** PROC08b **Tabletting, compression, extrusion or pelletisation -** PROC14 **Drum and small package filling -** PROC09 **Clean-down and maintenance of equipment -** PROC08a **Storage -** PROC01, PROC02
Industry Association	Concawe - 2017
Processes and activities covered by the exposure scenario	Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tabletting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities.

Section 2 - Exposure controls

2.1 Control of environmental exposure

Amounts used	Annual site tonnage (tonnes/year) 13000 Maximum daily site tonnage (kg/day)42000
Frequency and duration of use	Continuous release Emission days (days per year) 300
Other conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM) 0.0025 Release fraction to wastewater from process (initial release prior to RMM) 5.0E-6 Release fraction to soil from process (initial release prior to RMM) 0.0001
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%) 85,7
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.

Section 2 - Exposure controls

Conditions and measures related to sewage treatment plant	Estimated substance removal from wastewater via domestic sewage treatment (%) 94,2 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs (%) 94,2 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal (kg/day) 67000 Assumed on-site sewage treatment plant flow (m^3/d) 2000

2.2 Control of worker exposure

General measures applicable to all activities

Concentration of substance in mixture or article	Covers percentage substance in the product up to 100 %.
Frequency and duration of use	Covers daily exposures up to 8 hours
Other conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented Assumes use at not more than 20°C above ambient temperature. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Risk management measures (RMM)

Clean-down and maintenance of equipment - PROC 8a
Drain down system prior to equipment break-in or maintenance.

Storage - PROC 1 & 2
Store substance within a closed system.

Section 3 - Exposure estimation and reference to its source

3.1 Environment

Exposure assessment (environment):	The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model. Risk Characterisation Ratio (RCR) air 0.11 Risk Characterisation Ratio (RCR) water 0.87

3.2 Workers

Exposure assessment (human):	Qualitative approach used to conclude safe use.
Exposure estimation and reference to its source	A DNEL (derived no effect levels) cannot be derived. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Section 1 - Title

Short title of the exposure scenario	Use in functional fluids - Industrial
List of use descriptors	**Identified use name:** Use in functional fluids - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC09 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC07
Environmental contributing scenarios	**Use of functional fluid at industrial site -** ERC07
Health Contributing scenarios	**General exposures (closed systems) -** PROC02 **Bulk transfers -** PROC01, PROC02, PROC03 **Storage -** PROC01, PROC02 **Drum/batch transfers -** PROC08b **Filling of articles/equipment -** PROC09 **Filling of equipment from drums or containers -** PROC08a **General exposures (open systems) -** PROC04 **Remanufacture of reject articles -** PROC09
Industry Association	Concawe - 2017
Processes and activities covered by the exposure scenario	Use as functional fluids e.g. cable oils, transfer oils, coolants, insulators, refrigerants, hydraulic fluids in industrial equipment including maintenance and related material transfers.

Section 2 - Exposure controls

2.1 Control of environmental exposure

Amounts used	Annual site tonnage (tonnes/year) 10 Maximum daily site tonnage (kg/day) 500
Frequency and duration of use	Continuous release Emission days (days per year) 20
Other conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM) 0.0005 Release fraction to wastewater from process (initial release prior to RMM) 1.0E-6 Release fraction to soil from process (initial release prior to RMM) 0.001
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to sewage treatment plant	Estimated substance removal from wastewater via domestic sewage treatment (%) 94,2 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs (%) 94,2 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal (kg/day) 8100 Assumed on-site sewage treatment plant flow (m^3/d) 2000

2.2 Control of worker exposure

General measures applicable to all activities

Frequency and duration of use	Covers daily exposures up to 8 hours

Section 2 - Exposure controls

Other conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented Assumes use at not more than 20°C above ambient temperature. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Risk management measures (RMM)

General exposures (open systems), Elevated temperature - PROC 04
Restrict area of openings to equipment. Provide extract ventilation to points where emissions occur. Local exhaust ventilation - efficiency of at least 90 %.

Clean-down and maintenance of equipment - PROC 8a
Drain down system prior to equipment break-in or maintenance.

Storage - PROC 1, 2
Store substance within a closed system.

Section 3 - Exposure estimation and reference to its source

3.1 Environment

Exposure assessment (environment):	Not available.

3.2 Workers

Exposure assessment (human):	Qualitative approach used to conclude safe use.
Exposure estimation and reference to its source	A DNEL (derived no effect levels) cannot be derived. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Section 1 - Title

Short title of the exposure scenario	Use in functional fluids - Professional
List of use descriptors	**Identified use name:** Use in functional fluids - Professional **Process Category:** PROC01, PROC02, PROC03, PROC08a, PROC09, PROC20 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC09a, ERC09b, ESVOC SpERC 9.13b.v1
Environmental contributing scenarios	**Widespread use of functional fluid (outdoor) -** ERC09b **Widespread use of functional fluid (indoor) -** ERC09a
Health Contributing scenarios	**Drum/batch transfers -** PROC08a **Transfer from/pouring from containers -** PROC09 **Operation of equipment containing engine oils and similar -** PROC01, PROC02, PROC03, PROC20 **Remanufacture of reject articles -** PROC09 **Equipment cleaning and maintenance -** PROC08a **Storage -** PROC01, PROC02
Industry Association	Concawe - 2017
Processes and activities covered by the exposure scenario	Use as functional fluids e.g. cable oils, transfer oils, coolants, insulators, refrigerants, hydraulic fluids in industrial equipment including maintenance and related material transfers.

Section 2 - Exposure controls

2.1 Control of environmental exposure

Amounts used	Annual site tonnage (tonnes/year)0,016 Maximum daily site tonnage (kg/day)0,044
Frequency and duration of use	Continuous release Emission days (days per year) 365
Other conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM) 0.05 Release fraction to wastewater from process (initial release prior to RMM) 0.013 Release fraction to soil from process (initial release prior to RMM) 0.025
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of (%) 38,5

2.2 Control of worker exposure

General measures applicable to all activities

Concentration of substance in mixture or article	Covers percentage substance in the product up to 100 %.
Frequency and duration of use	Covers daily exposures up to 8 hours
Other conditions affecting workers exposure	Assumes a good basic standard of occupational hygiene is implemented Assumes use at not more than 20°C above ambient temperature. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

Risk management measures (RMM)

Section 2 - Exposure controls

Drum/batch transfers - PROC 8a
Use drum pumps.

Clean-down and maintenance of equipment - PROC 8a
Drain down system prior to equipment break-in or maintenance.

Storage - PROC 1, 2
Store substance within a closed system.

Section 3 - Exposure estimation and reference to its source

3.1 Environment

Exposure assessment (environment):	Not available.

3.2 Workers

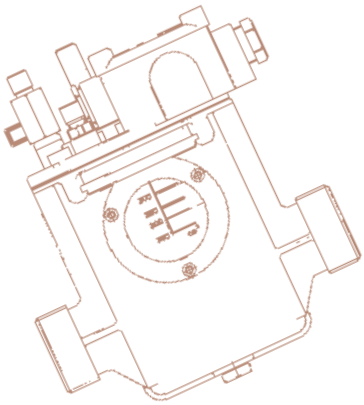
Exposure assessment (human):	Qualitative approach used to conclude safe use.
Exposure estimation and reference to its source	A DNEL (derived no effect levels) cannot be derived. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

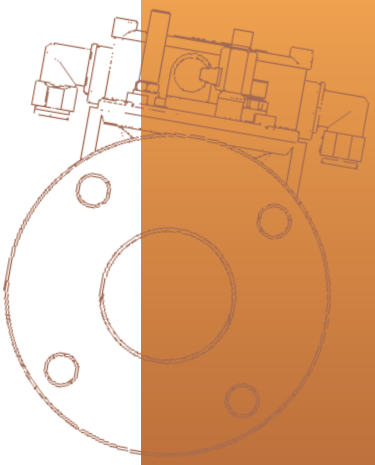
SECTION 8

APPENDIX B

BUCHHOLZ RELAY:
ABB/COMEM BS50LA

(MANUFACTURER DETAILS - 18 PAGES)





GAS-ACTUATED RELAYS

BUCHHOLZ TYPE

ACCORDING TO

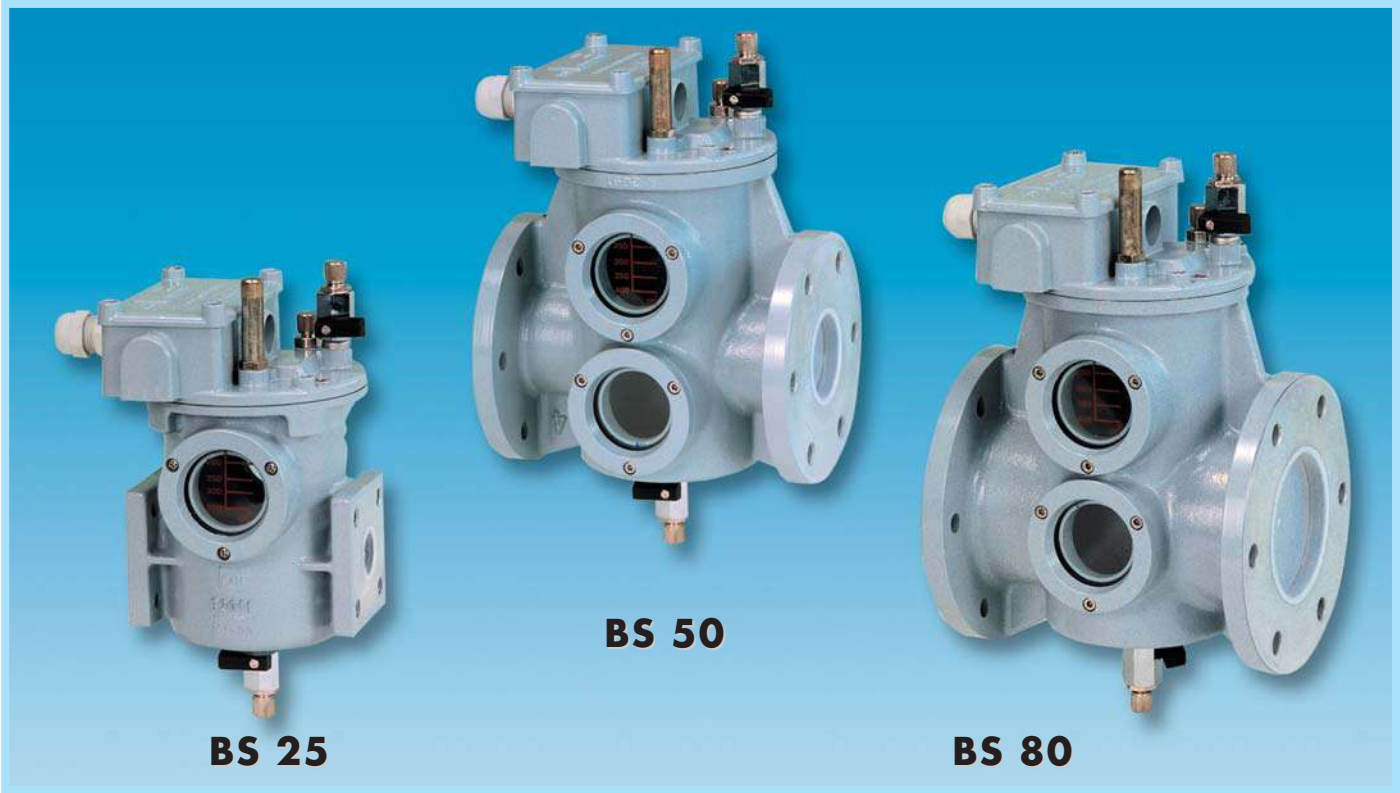
CENELEC EN 50216-2 STANDARD

AND

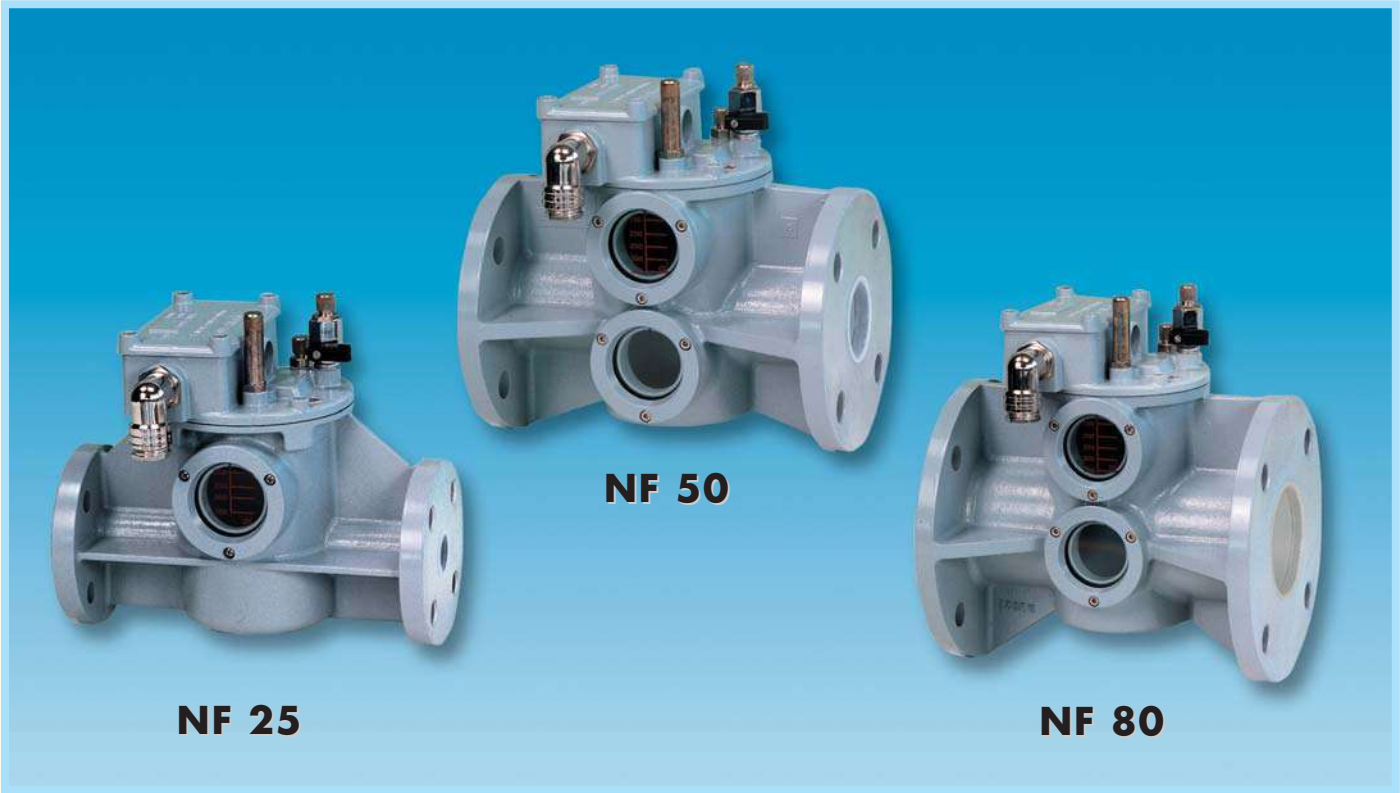
GAS SAMPLING DEVICE

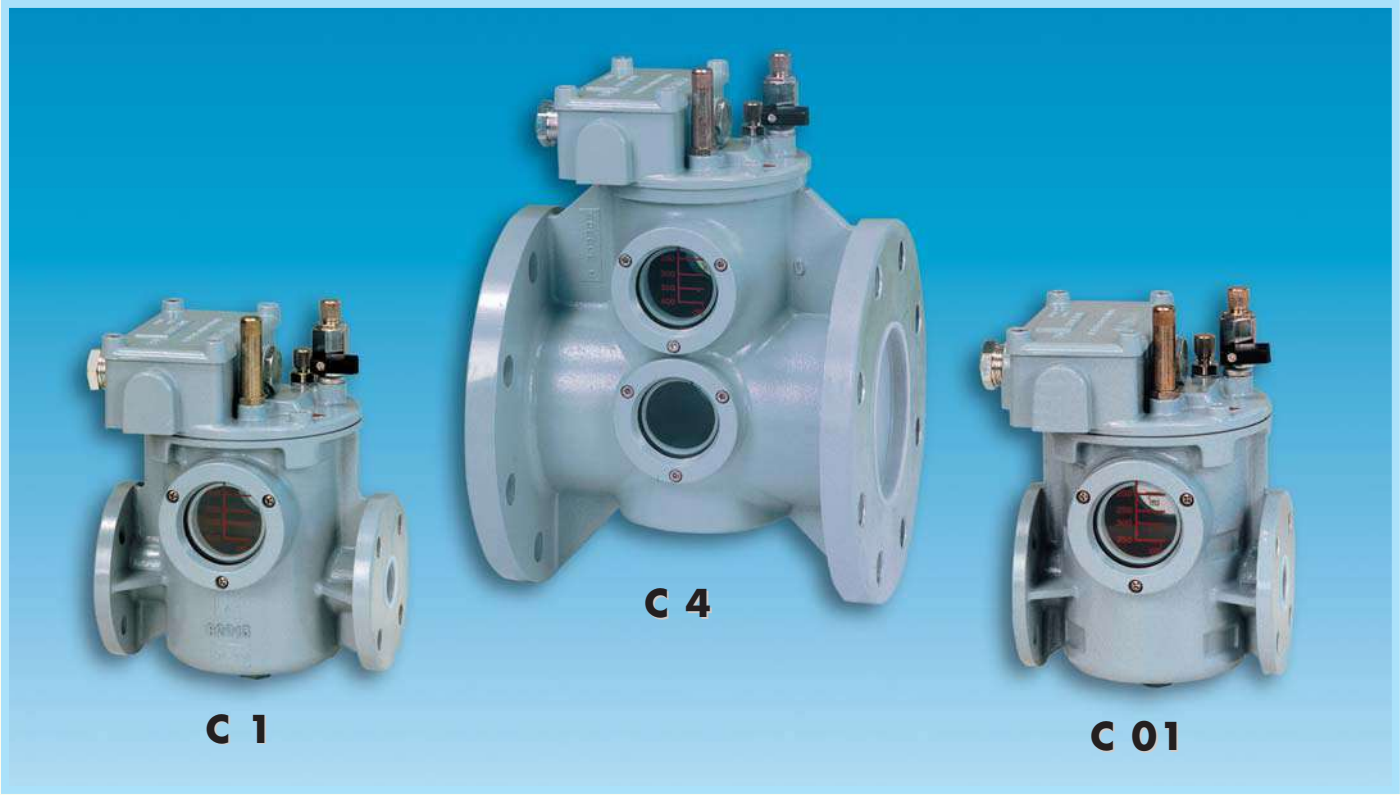
comem®

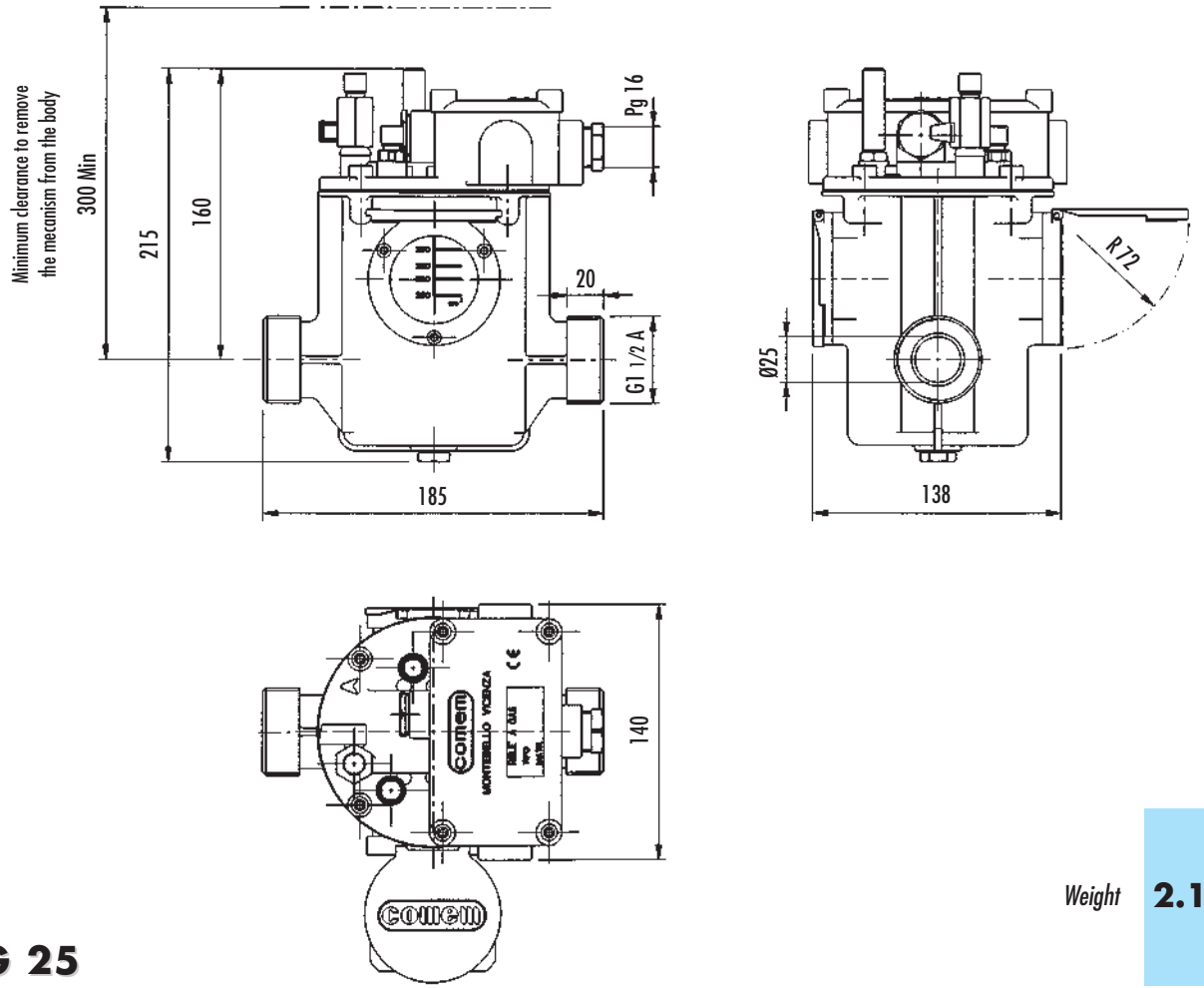
GAS-ACTUATED RELAYS BUCHHOLZ TYPE



GAS-ACTUATED RELAYS BUCHHOLZ TYPE







BG 25

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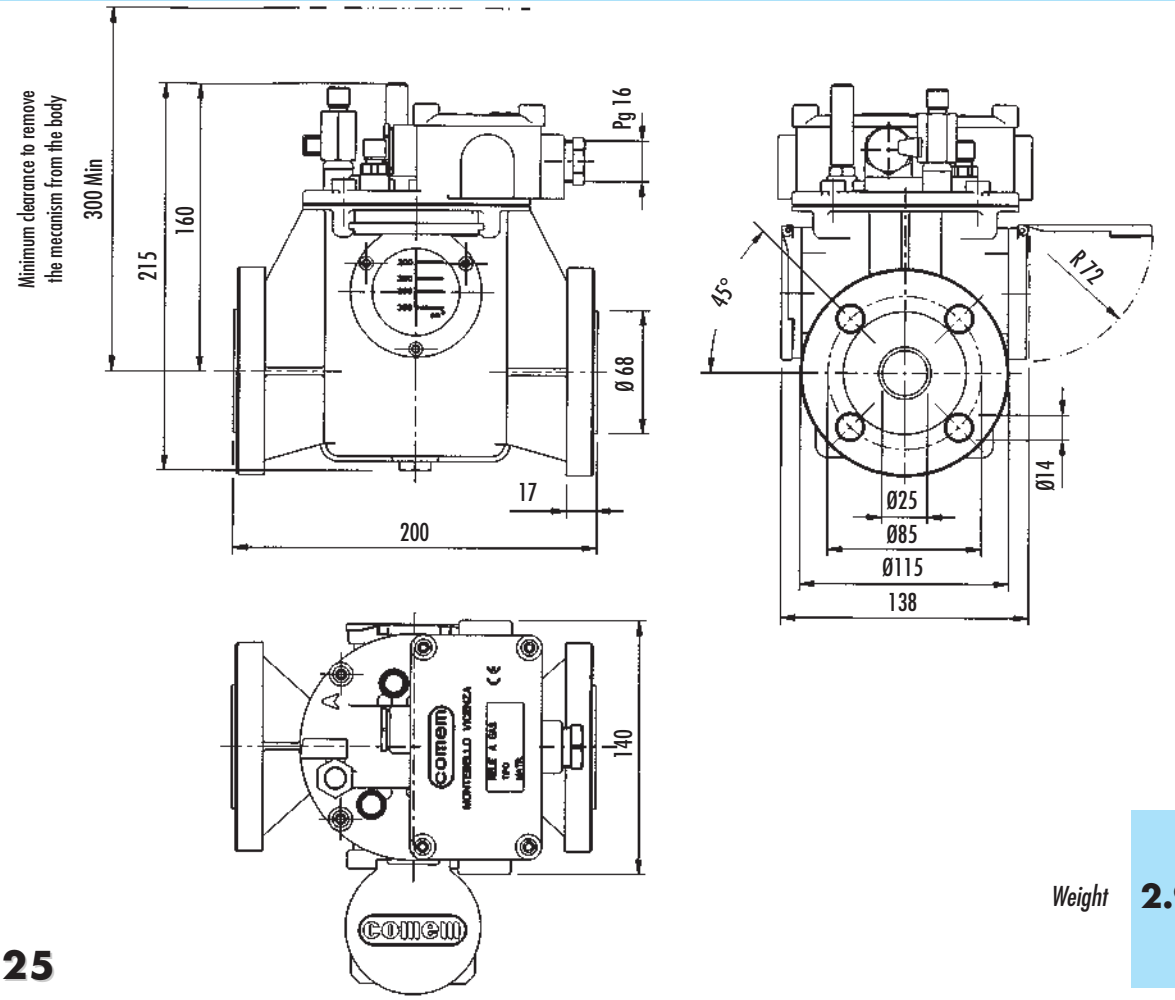

BR 25

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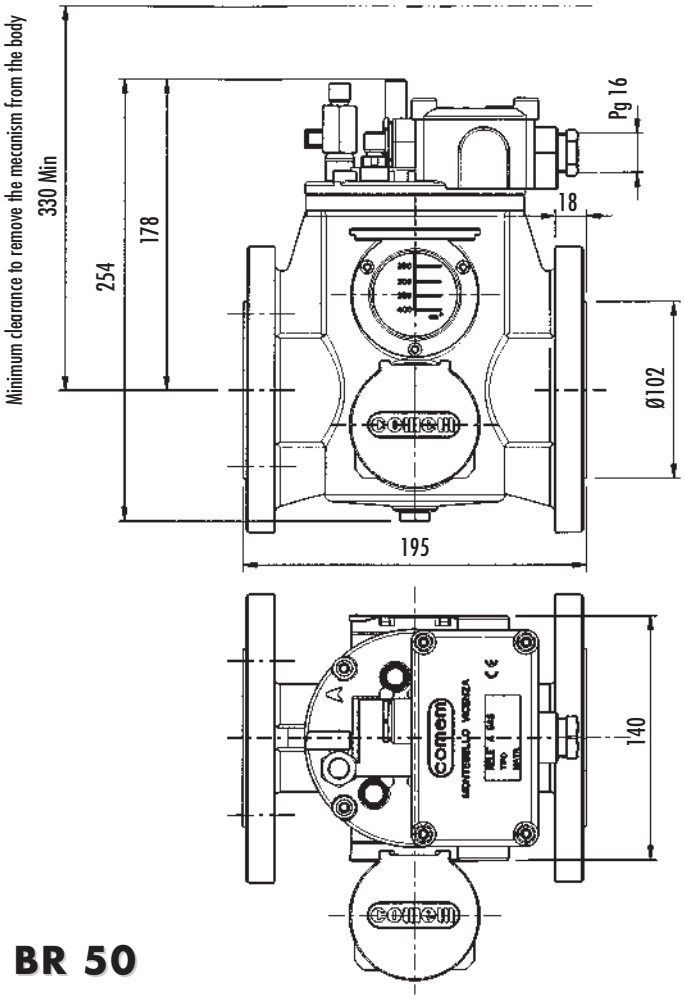
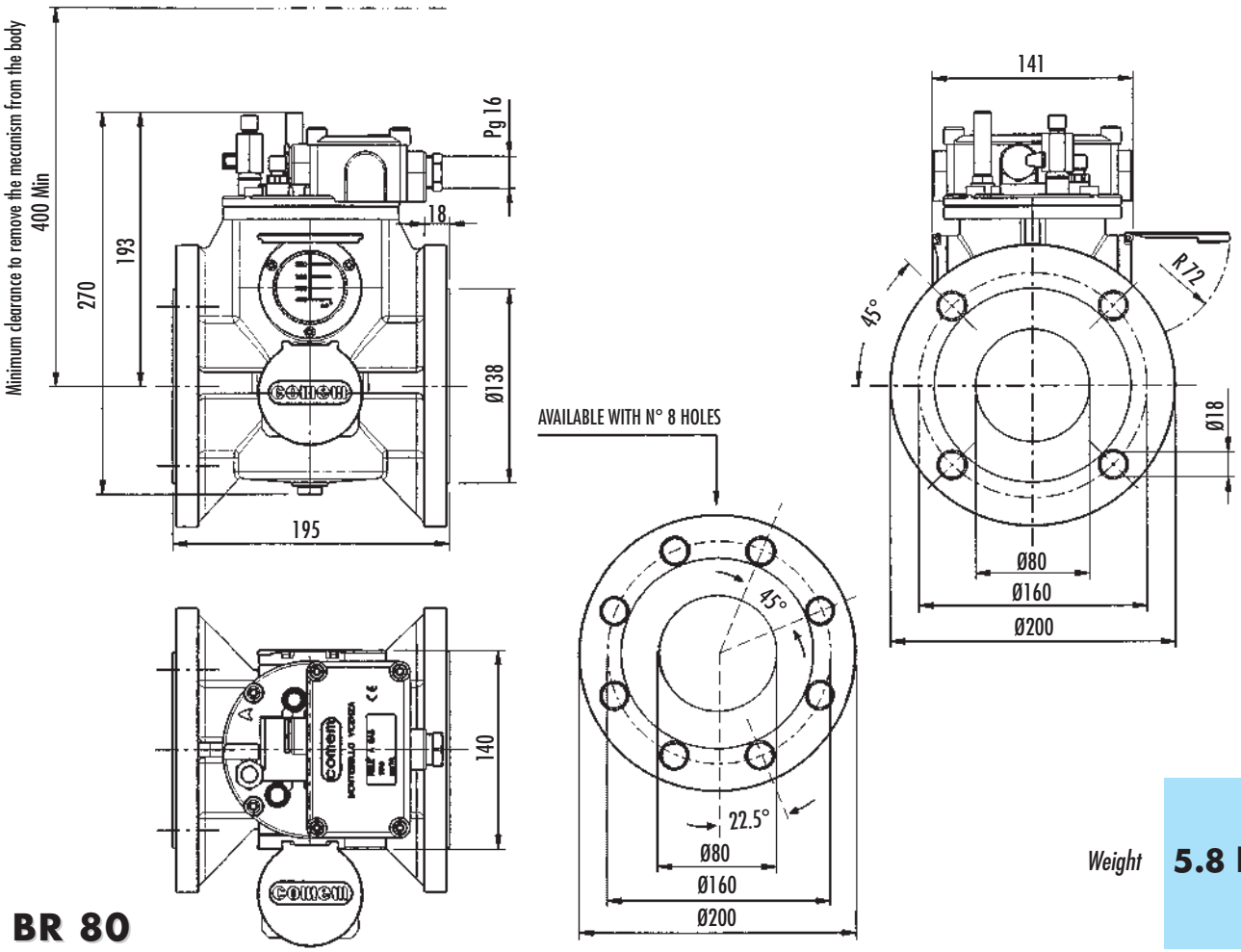


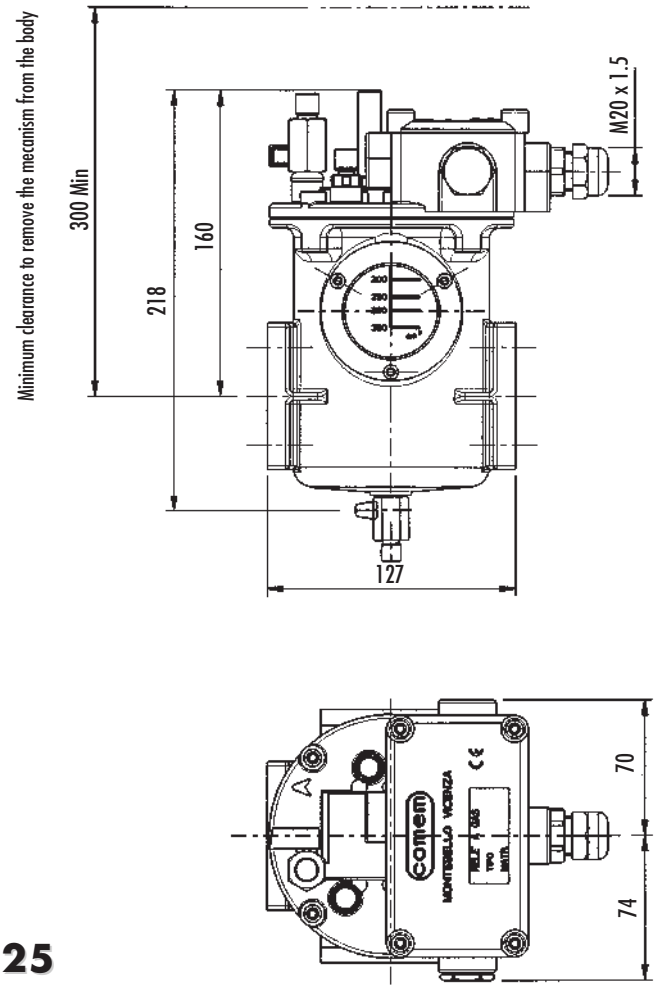
BR 50

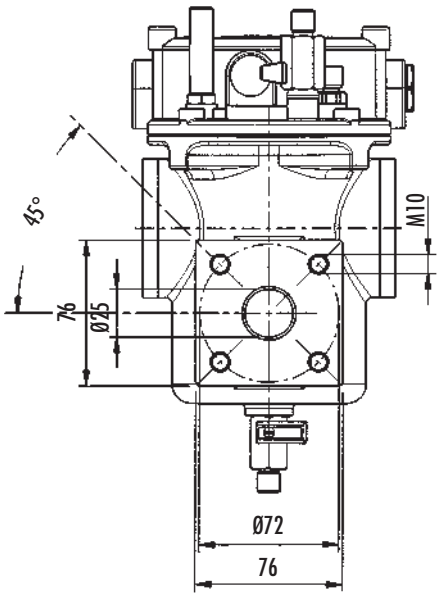
Weight **4.9 kg**



BR 80

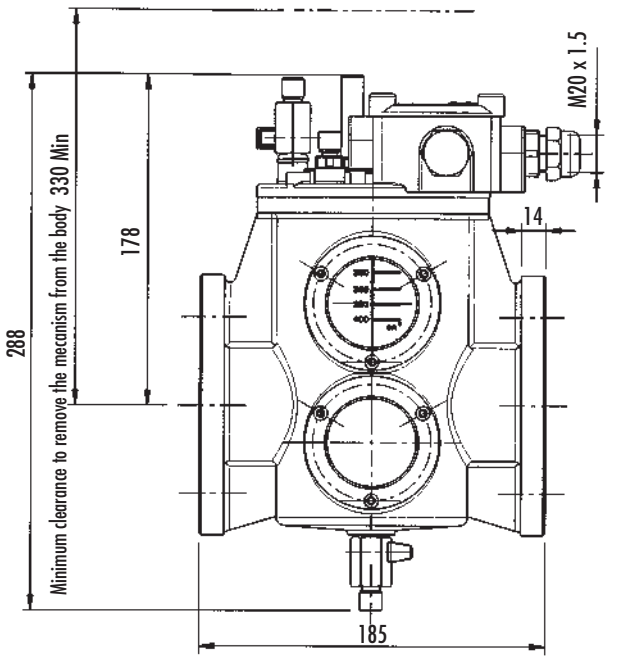
Weight **5.8 kg**

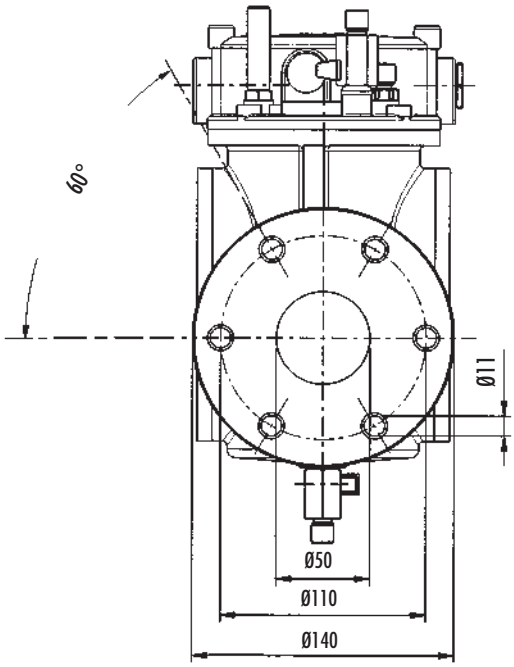




BS 25

Weight **2.2 kg**





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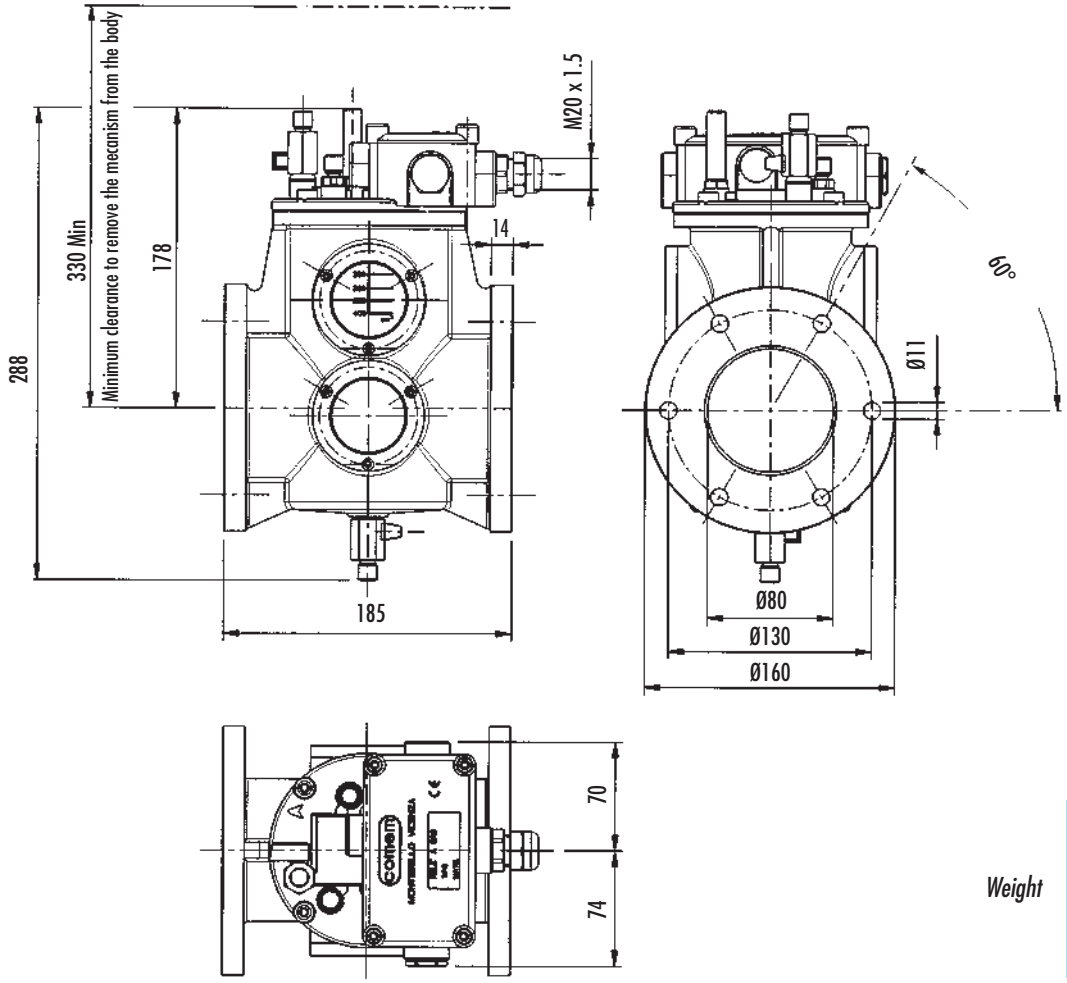

BS 80

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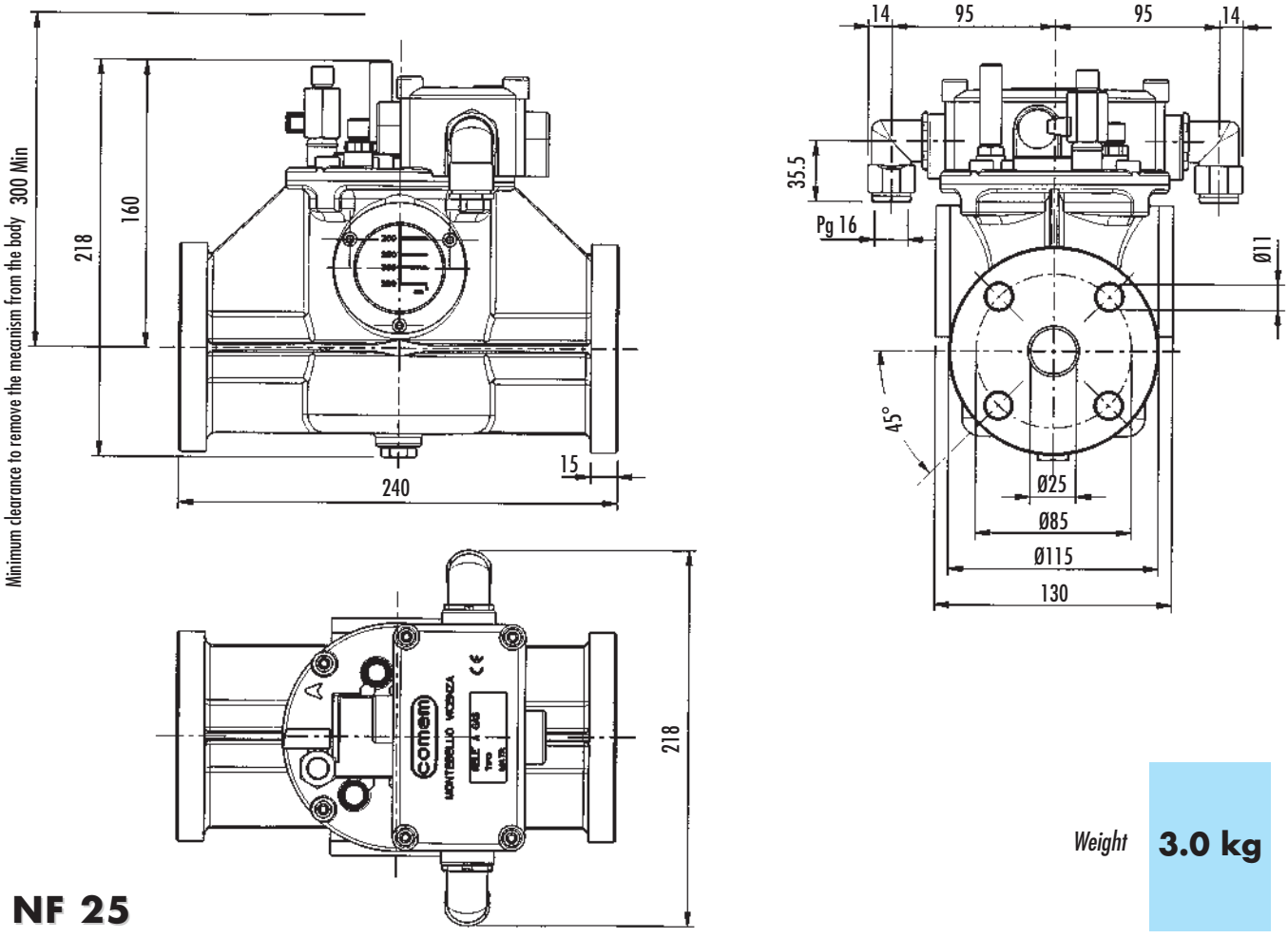

NF 25

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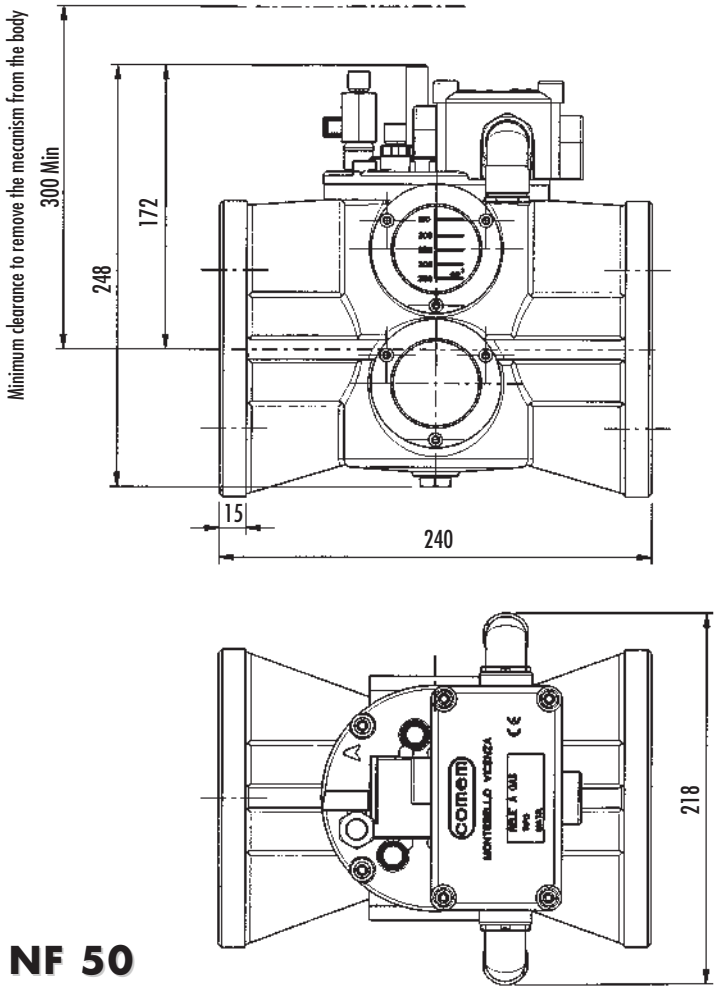
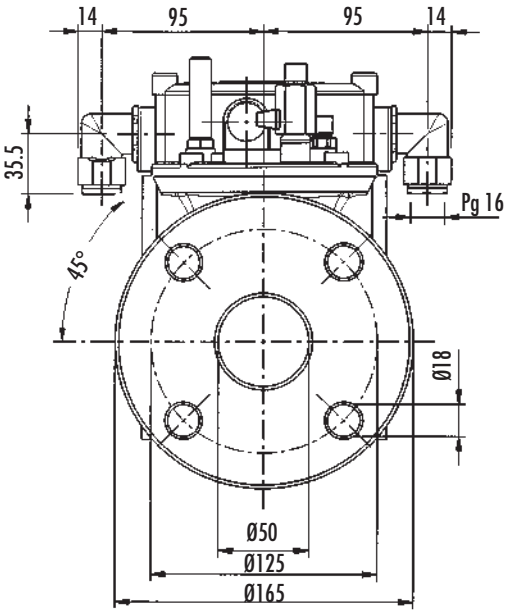
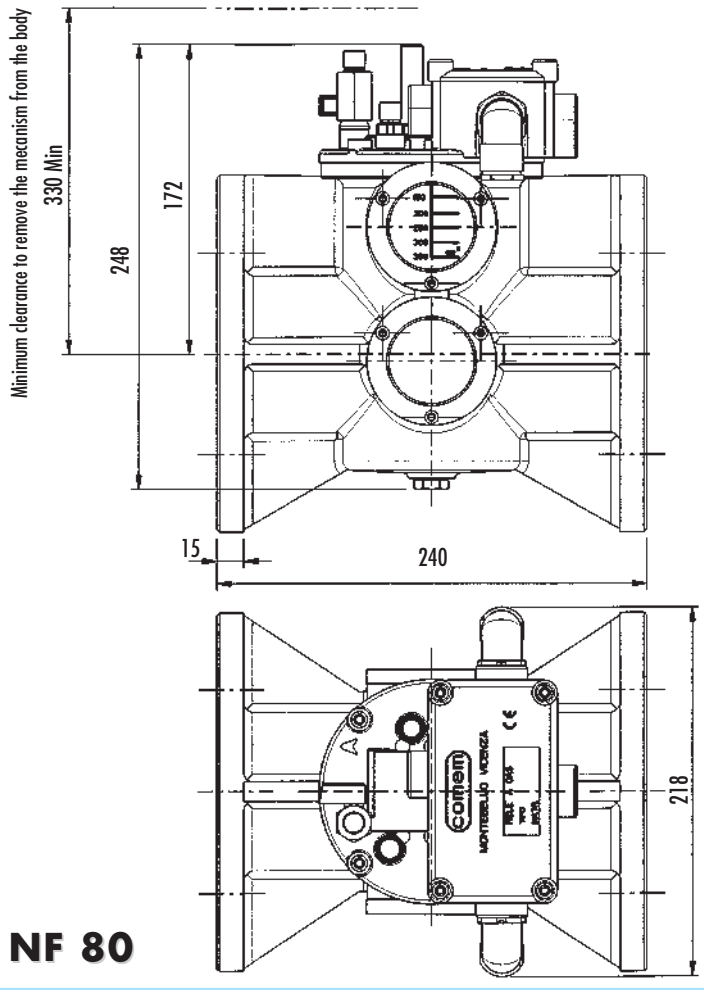
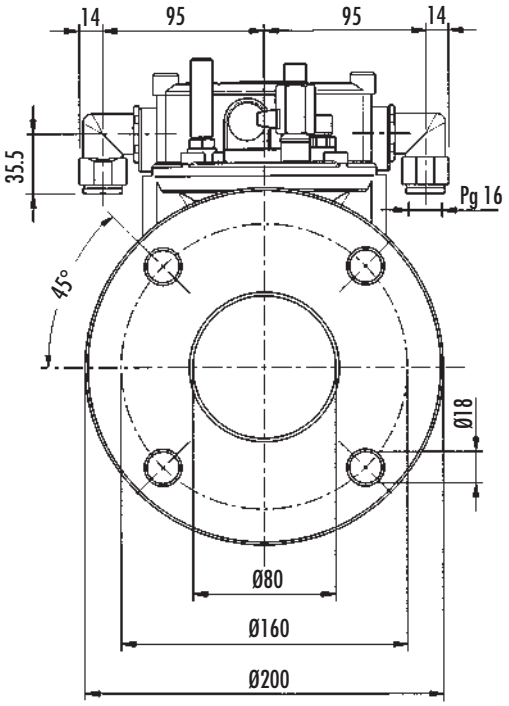




NF 50

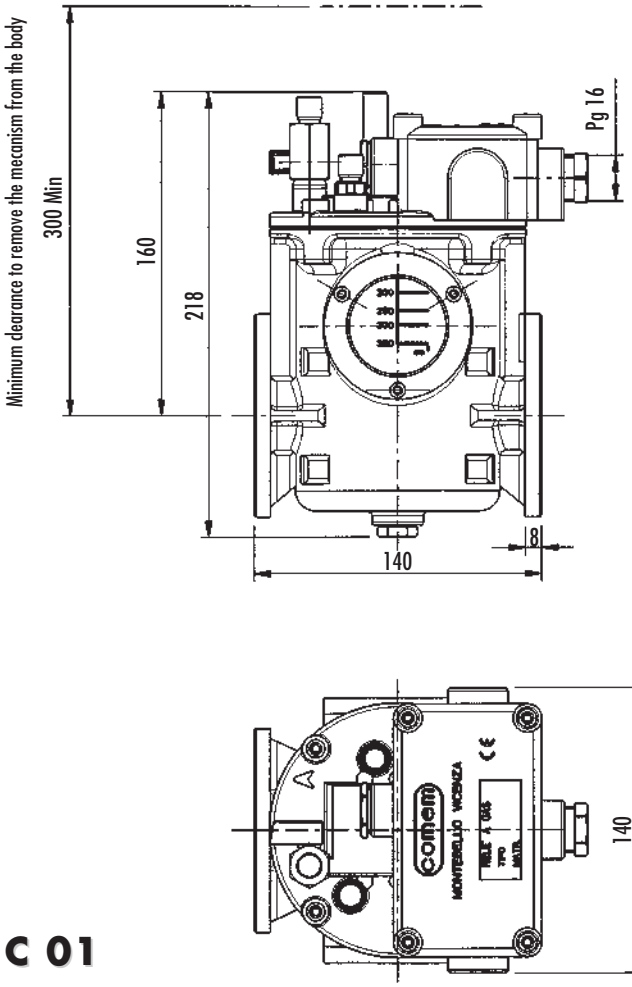
Weight **4.8 kg**

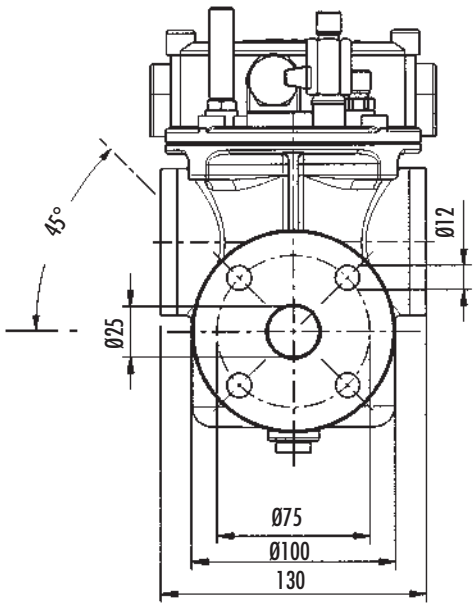




NF 80

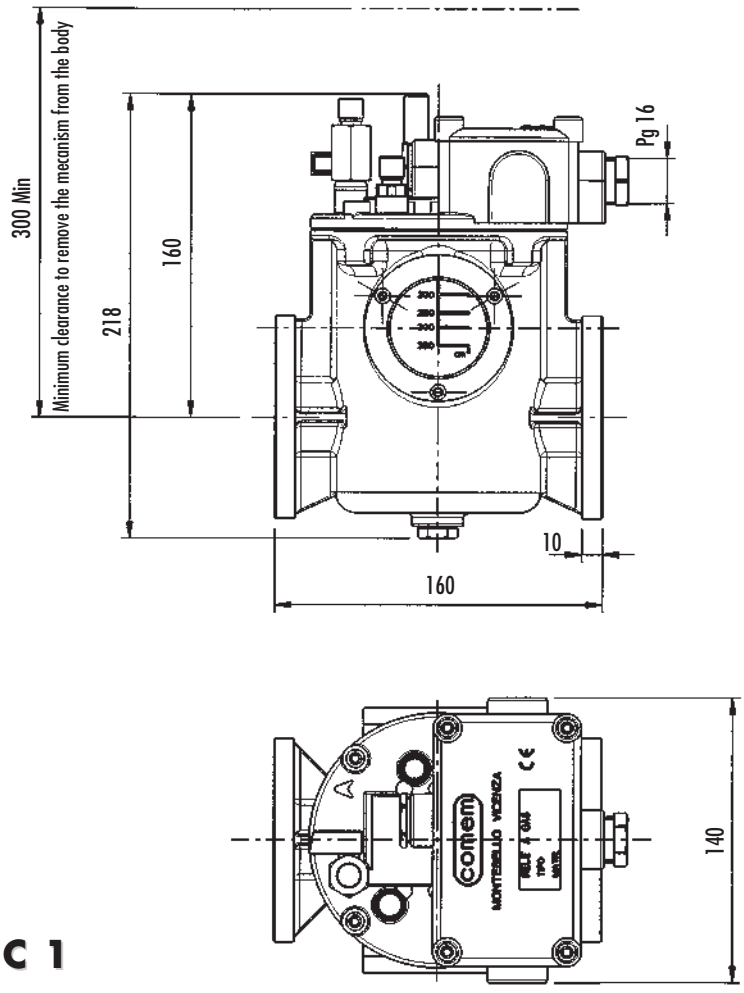
Weight **5.5 kg**

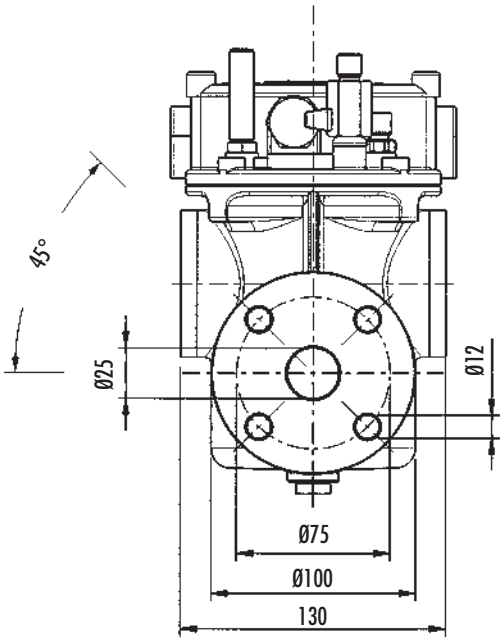




C 01

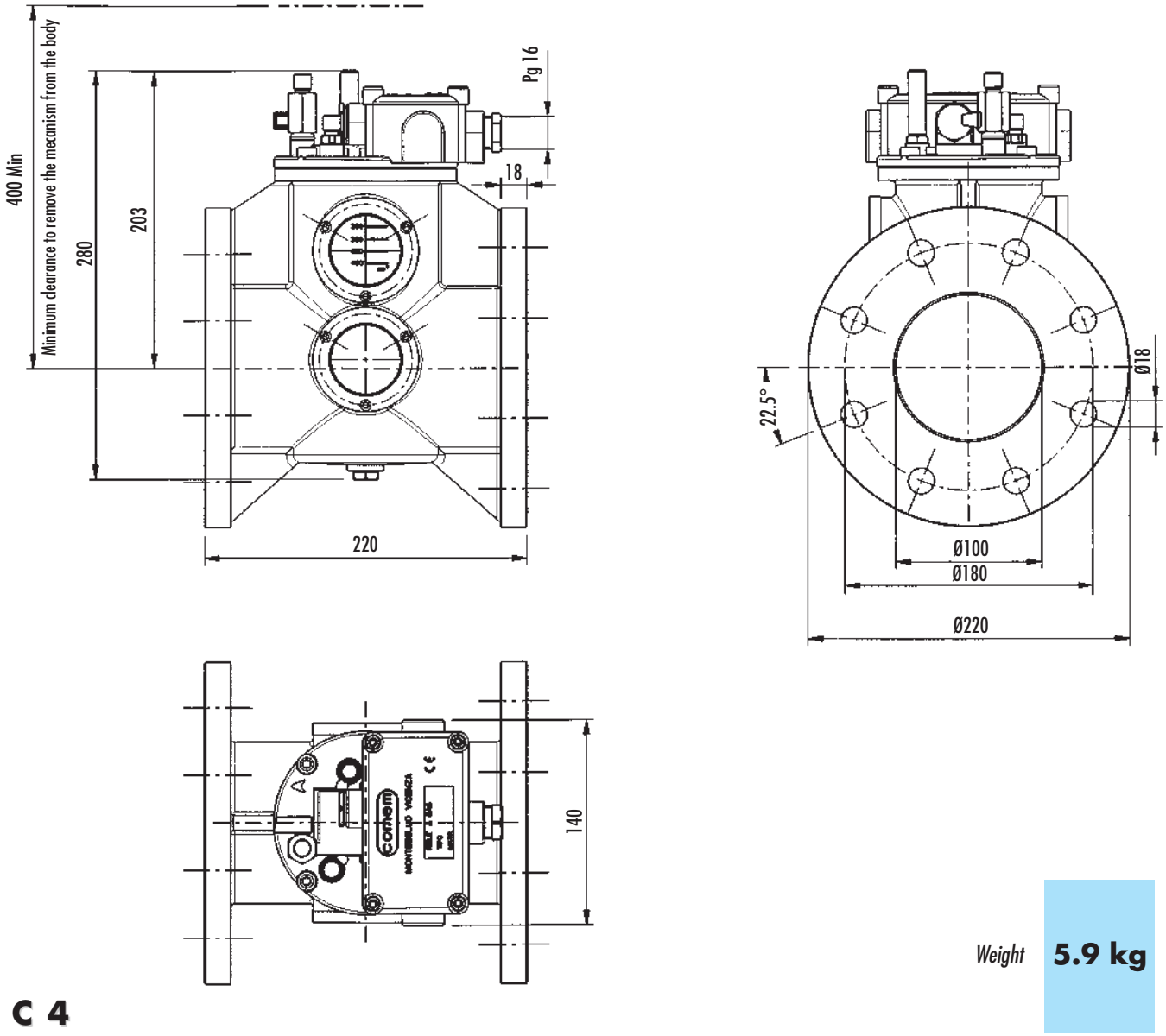
Weight **2.2 kg**





C 1

Weight **2.3 kg**



C 4

Weight **5.9 kg**

BUCHHOLZ GAS-ACTUATED RELAY
to CENELEC EN 50216-2 standard

The generation of gas in an oil filled trasformer is a clear indication of a problem. The gas may be a result of the following:

- Decomposition/degradation of solid, or liquid insulation inside the transformer due to overheating, or arcing.
- From the outside towards the pipeline.
- From the oil itself due to unsatisfactory de-gassing prior to filling.

Rapid oil movement in the pipeline towards the conservator is caused by an internal arc, short circuit, or hot spot which must be correctely addressed.

Oil leaks from the transformer are environmentally unacceptable and a fire hazard will lead to transformer failure.

To indicate any of the above malfunctions Comem as the result of 40 years experience with these products has developed a new "Buchholz" relay to comply fully with the latest CENELEC EN 50216-1 and EN 50216-2 standards.

The new relay incorporates the very latest technology in its construction.

PRINCIPLE OF OPERATION

The Buchholz relay is sited in the pipework between the transformer and its conservator and it is filled with oil during normal transformer operation. When gas is generated in the transformer it rises towards the conservator and collects in the upper chamber of the relay.

The oil level drops and the top float triggers alarm switch.

Gas shall not freely pass from the relay body and escape into the pipewoek before the alarm contact has operated.

The trip contact shall operate at a steady oil flow as indicated in Table 3.

This operation shall not be adversely affected when the alarm contact has already closed and gas is escaping freely.

In the event of an oil leak the Buchholz relay will only operate after the conservator has exhausted all of its oil. In order to check this eventuality it is recommended that an RDR MK II automatic shutter valve is fitted between the Buchholz and the conservator.

Specific information on this product are available on request.

CONSTRUCTION

The new Comem Buchholz relay is an assembly of two machined aluminium alloy castings that effect a perfect oil seal.

1) The main body of the relay is fitted with tempered glass inspection windows with graduated scale markings in cubic centimetres to indicate the internal volume. The oil drain plug is located at the bottom of the main body.

2) The top cover carries the frame which contains the moving parts of the relay. These comprise the two floats and their associated switches encapsulated in glass bulbs, one calibrated flow valve and two permanent magnets.

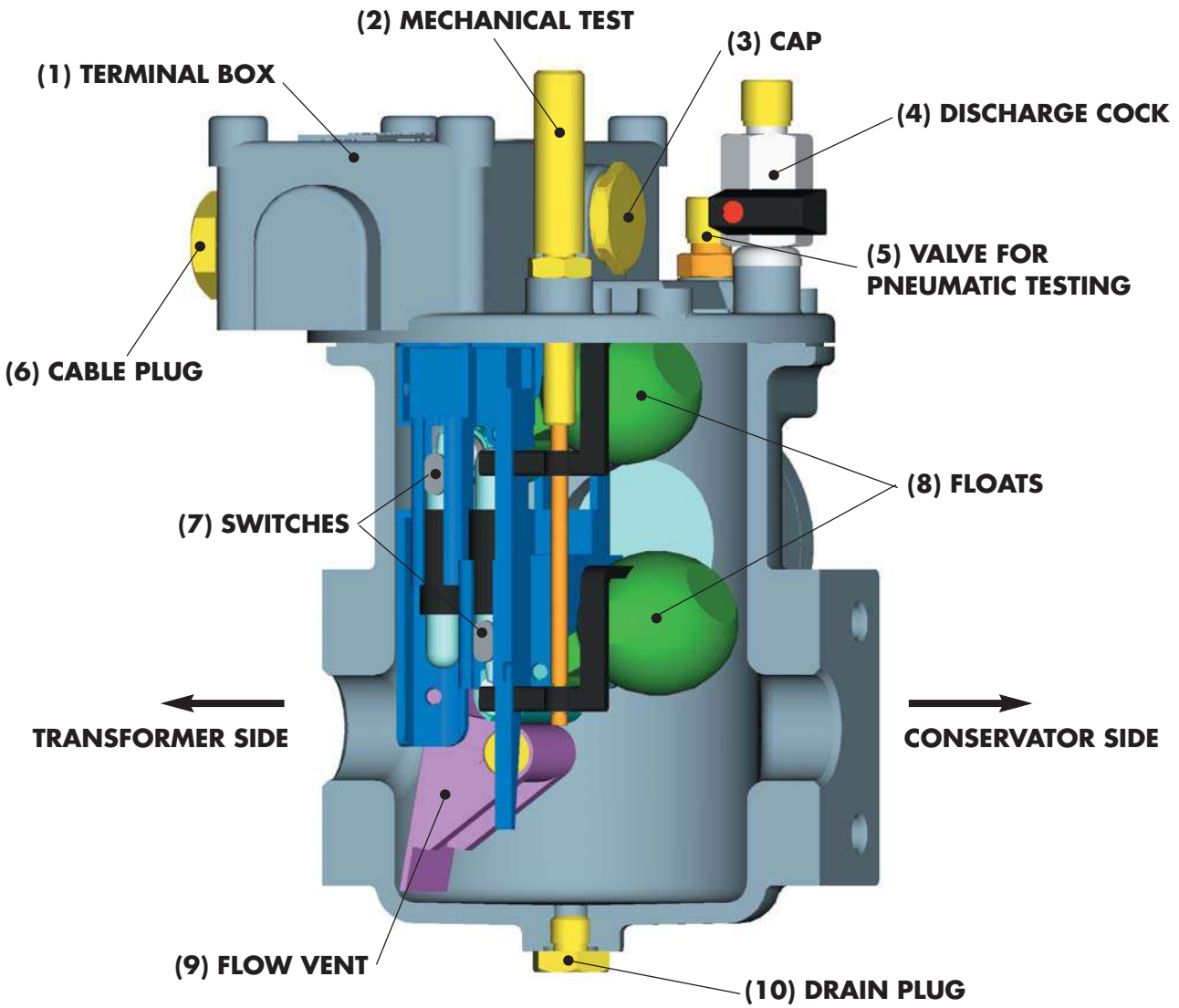
The cover also carries:

(4) a gas discharge valve with G1/8" in male thread with protective cap.

(5) A valve for pneumatically testing the alarm and insulation circuits, with protective cap.

(2) A push rod for mechanically tripping the alarm and the insulation circuits, with protective cap.

A terminal box which as standard contains 4 numbered M6 terminals and one earth terminal.



EXTERNAL COATING AND PROTECTION

To the external aluminium alloy parts is given a phosphate treatment prior to applying one coat of vinyl enamel, colour RAL 7001. This treatment has proved more than satisfactory over the years for the majority of applications including desert and tropical situations. However, in particularly severe applications (>500h salt fog) such as applications in corrosive atmospheres (acids) a suitable epoxy primer is recommended. (This should be discussed at the time of selection).

All external brass fittings are plated and all nuts are made in stainless steel.

RELAY SELECTION

The size and type of relay to be used will depend on the transformer rating and oil volume. Suggestions are given in the following table but the final choice is often as a result of the transformer manufacturers experience.

MVA TRANSFORMER POWER	NOMINAL DIAMETER
Up to 5	25
From 5 up to 20	50
From 20 up to 50	80
Over 50	100

tab. 1

TECHNICAL DATA

- The relay pipework is typically mounted at 2,5 degrees to the horizontal. A positive inclination of up to 5 degrees to the horizontal axis is admissible.
- Operating pressure - 1 bar, tested to 2,5 bar for 2 minutes at 100 deg C.
- Gas volume to trip alarm:

BUCHHOLZ RELAY TYPE	GAS VOLUME NECESSARY TO TRIP THE ALARM
BG 25, BR 25, NF 25, C 01 , C 1	100÷200
NF 50, NF 80	100÷200
BR 50 , BR 80, C 4	150÷250
BS 25	170÷230
BS 50, BS 80	250÷300

tab. 2

- Rate of oil flow in m/s to trip insulation. In the following table standard values are highlighted with an '**O**' available, on request with an '**X**' and not available with a '**//**'. +/- 15% tolerance at 20°C with oil viscosity according to IEC296.

INSIDE PIPE DIAMETER	1,0 m/s	1,5 m/s	2,0 m/s
25	**O**	**X**	**X**
50	**O**	**X**	**X**
80	**O**	**X**	**X**
100	//	**O**	**X**

tab. 3

- The relay operates within 0,5 seconds.
- Oil temperature between -25 and +115 deg C.
- Ambient temperature between -25 and +60 deg C.
- Degree of Protection IP65 to EN 60529.

SWITCH ELECTRICAL DATA

Rated switch current is **2 A r.m.s**. with max. **10 A r.m.s.** as short term 30 ms current value.
Breaking power is specified in the following table:

VOLTAGE	CURRENT	BREAKING POWER	
220 V d.c. (min. 12 V)	2 A for 10000 maneuvers	250 W	L/R < 40 ms
230 V a.c. (min. 12 V)	6 A for 1000 maneuvers	400 VA	cos φ > 0,5

tab. 4

Dielectric contact voltage as specified in the following table:

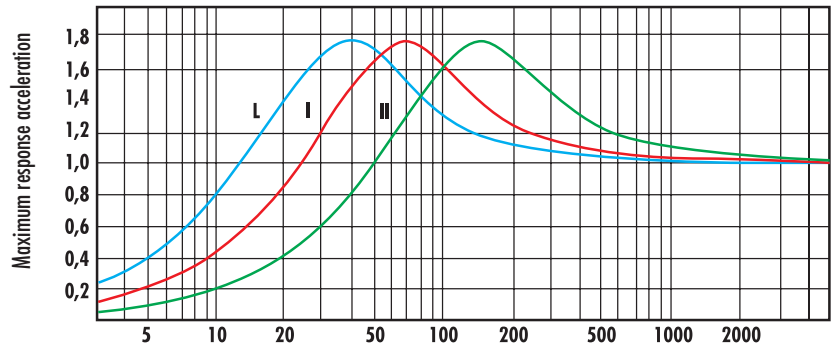
	SHORT TERM INDUSTRIAL FREQUENCY LEAKAGE TEST kV/1 min. (r.m.s)	RESISTANCE VOLTAGE PER PULSE kV (peak)
Between circuits and ground	2.5	5
Across open contacts	1	3

tab. 5

TESTING

The following Type Tests have been performed on the relay.

- Measurement of the volume of gas necessary to trip the alarm.
- 500 hr salt fog.
- Electromagnetic Field Test. Relay does not trip in field strength up to **25 mT** (ref EN 50216-2).
- Stationary sinusoidal mechanical vibrations. Tests according to EN 60721-3-4 standards have been performed.
  a) class **4M4** (4M6 on request) vibration test applied in sites where vibrations are transmitted from machinery and vehicles. Not suitable for machines exposed to high vibration and shock levels. Three-axis movement was impressed to the relay using special equipment with stationary sinusoidal vibrations from **2** to **200 Hz.** Movement had a constant **3 mm** (6 mm peak-peak) amplitude in the range from **2** to **9 Hz** whereas above this frequency it had constant **10 m/s²** acceleration. The alarm and release switches did not trip.
  b) non-stationary vibration tests with vertical shock with **100 m/s²** acceleration with type I spectrum (duration 11 ms) as shown in the graph below. Alarm and release contacts did not trip. On demand we are able to manufacture Buchholz relays with special features and test values higher than the ones stated above.



Example duration of a sinusoidal half pulse:

Type L spectrum: 22 ms duration

Type I spectrum: 11 ms duration

Type II spectrum: 6 ms duration

- A seismic test was also performed according to EN 50216-1 standards that refers to EN 60068-3-3 class 0, level 2 standards. The test consists of application of a **9 m/s²** horizontal acceleration and a **4.5 m/s²** vertical acceleration, increasing frequency one octave per minute. No activation of alarm or release switches was encountered.
- Pressure Withstand Test 2.5 bar for 2 minutes with oil at 100 deg C.
- Vacuum Withstand Test of 2500 Pa for 24 hrs.
- Rate of oil flow test to operate trip contcts, (as shown in table 3).
- Test to show the relay is insensitive to oil flow from conservator to transformer.
- Electrical tests per table 5.

ROUTINE TESTS

The following Routine Tests are applied to all relays.

- Hydraulic seal test in mineral oil at 90 deg C and 100 kpa pressure for 30 minutes.
- Contact operation via mechanical push rod.
- Contact operation by lowering the oil.
- Rate of oil flow to trip contacts.
- Electrical withstand test between contacts (as table 5).
- Electrical withstand test between contacts and earth (as table 5).

An individual routine Test Report is shipped with each relay

RELAY OPERATING TEST

The following site Tests can be performed when the relay is installed on the transformer
The Alarm and Trip contacts can be tested manually by the push rod (2) - mechanical test, or (only for alarm contact) by the introduction of air into the relay through valve (5) - pneumatic test.
A bicycle pump can be utilised for this test or a kit article n° **5400806002** is available from Comem.
To effectively test the rate of flow of oil is a complex test requiring specialised equipment. Should this test be required other than as a type test then Comem can perform this on request at the time of the order.

INSTALLATION INSTRUCTIONS

The following installation procedures must be observed for proper relay operation:

- The red arrow on the relay must point towards the conservator.
- The relay must always be full of oil, which means that the minimun oil level in the conservator must be higher than the relays breather valve.
- The recommended inclination of the relay pipework is 2.5 degrees from the horizontal.
- The pipe from the transformer to the relay must exit the transformer at the highest point.
- The pipeline upstream from the relay has to be straight and with a length equal to **5-10 times** the pipeline diameter, at least. Down stream from the relay, pipeline length has to be **3 times** the pipeline diameter, only. It must rise up towards the conservator.

RELAY ORDER FORM

Chosen size and model (see drawings and table 1):

BG 25	BR 25	BR 50	BR 80	BR 80 8 holes	BS 25	BS 50	BS 80	NF 25	NF 50	NF 80	C 01	C 1	C 4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Electric contact layout (meaning with relay filled with oil and operating):

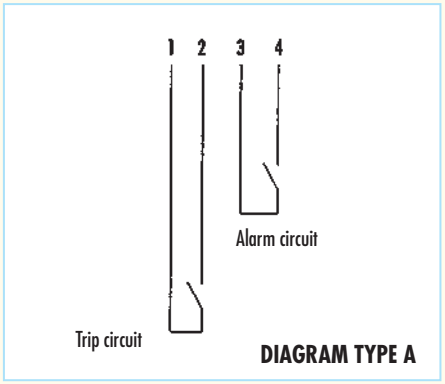


DIAGRAM TYPE A

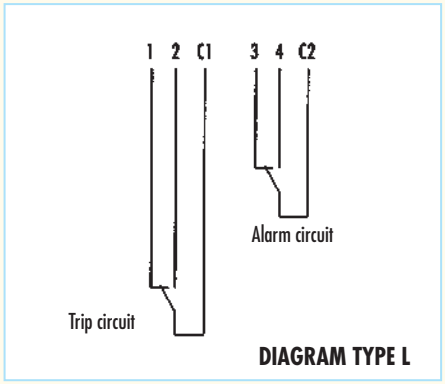


DIAGRAM TYPE L

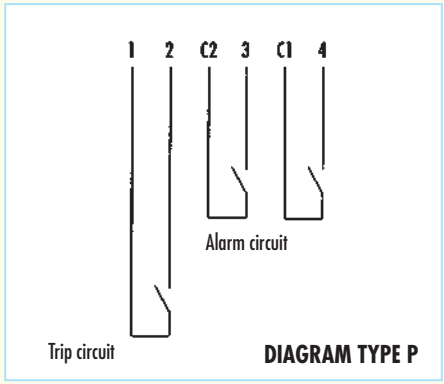


DIAGRAM TYPE P

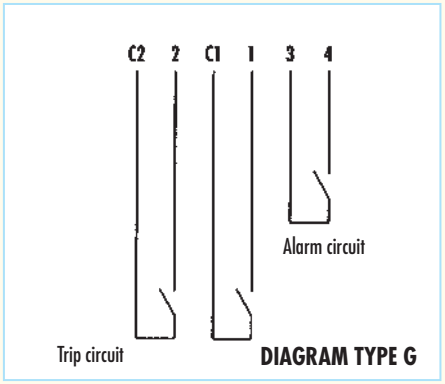


DIAGRAM TYPE G

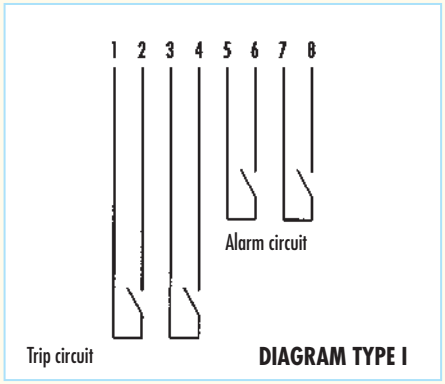


DIAGRAM TYPE I

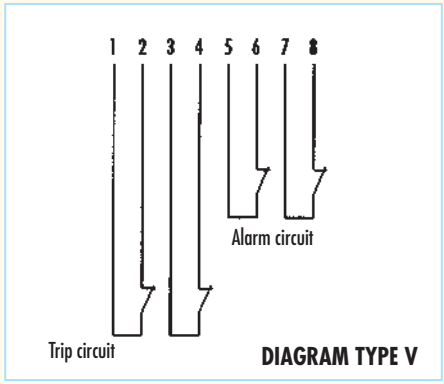


DIAGRAM TYPE V

A	L	P	G	I	V	Other
☐	☐	☐	☐	☐	☐	☐ _____

Chosen seals:

A	B	C	Other
☐	☐	☐	☐

	TYPE OF DIELECTRIC / AMBIENT TEMPERATURE/OIL		MINERAL	SILICONE	ESTERIZED
A	Ambient -25° ÷ 60° C Oil -25° ÷ 115° C	Standard version	NBR	VITON/NBR	//
B	Ambient -10 ÷ 60° C Oil -10° ÷ 115° C	Special version	//	VITON	VITON
C	Ambient -40° ÷ 60° C Oil -40° ÷ 115° C	Special version	NBR/VITON	NBR/VITON	NBR/VITON

(NBR/VITON: meaning: parts in contact with oil in VITON, parts not in contact with oil in NBR) tab. 6

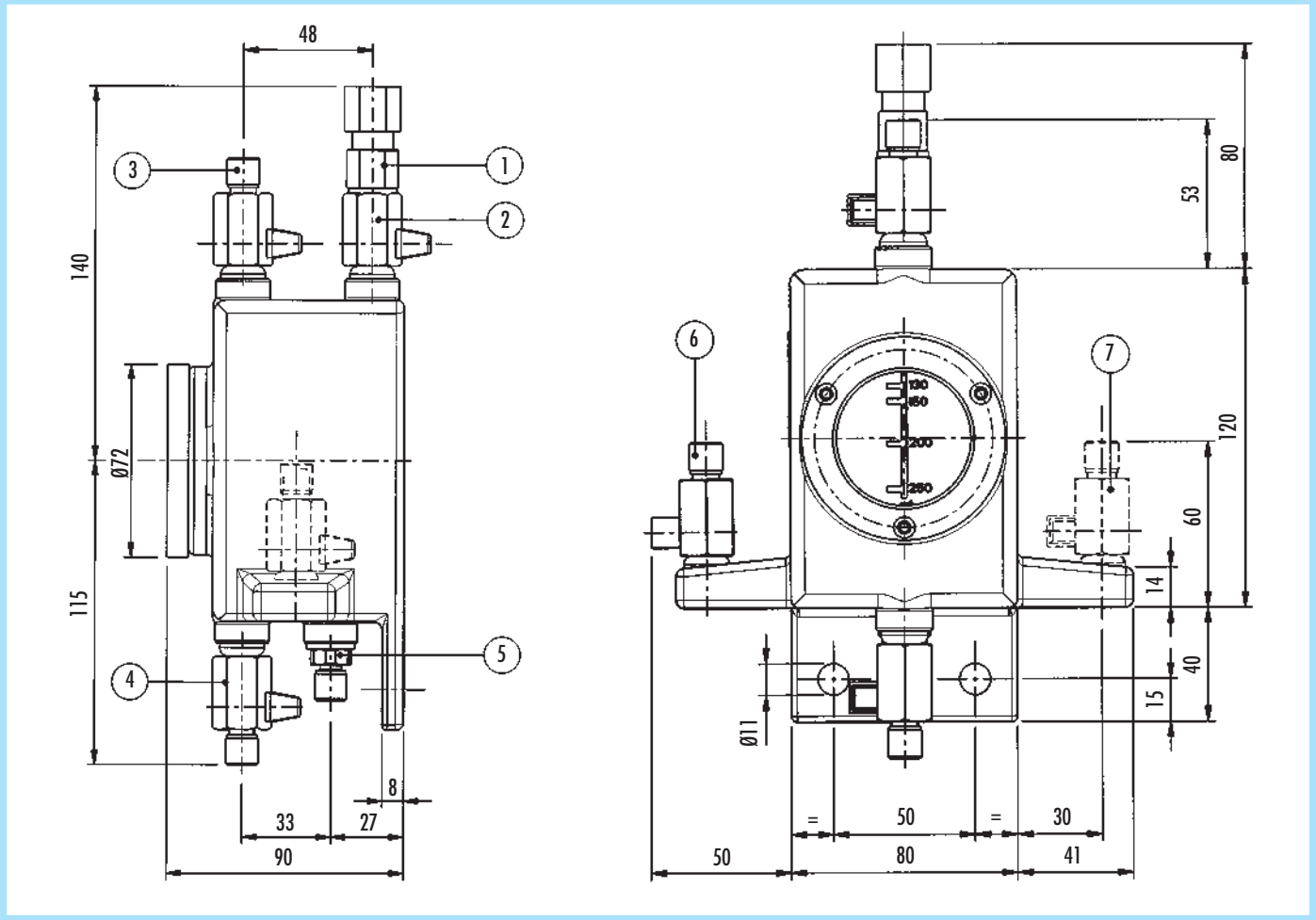
Paint finish:

Standard	Corrosive environments	Other special finishes
☐	☐	☐ _____

GAS SAMPLING DEVICE WITH APPLICATION OF THE BUCHHOLZ RELAY OIL DRAIN COCK

PRINCIPLE OF OPERATION

The presence of gas inside an oil filled transformer is always a sign of malfunction and one of the tasks of the Buchholz relay is to signal this presence. Analysis of the evolved gas can often give good indication of the type of malfunction but accessing the Buchholz relay during live operation of the transformer can be hazardous.
The gas sampling device has been designed to overcome this problem by siting the unit remote from the Buchholz and in a readily accessible position typically on the side of the transformer.

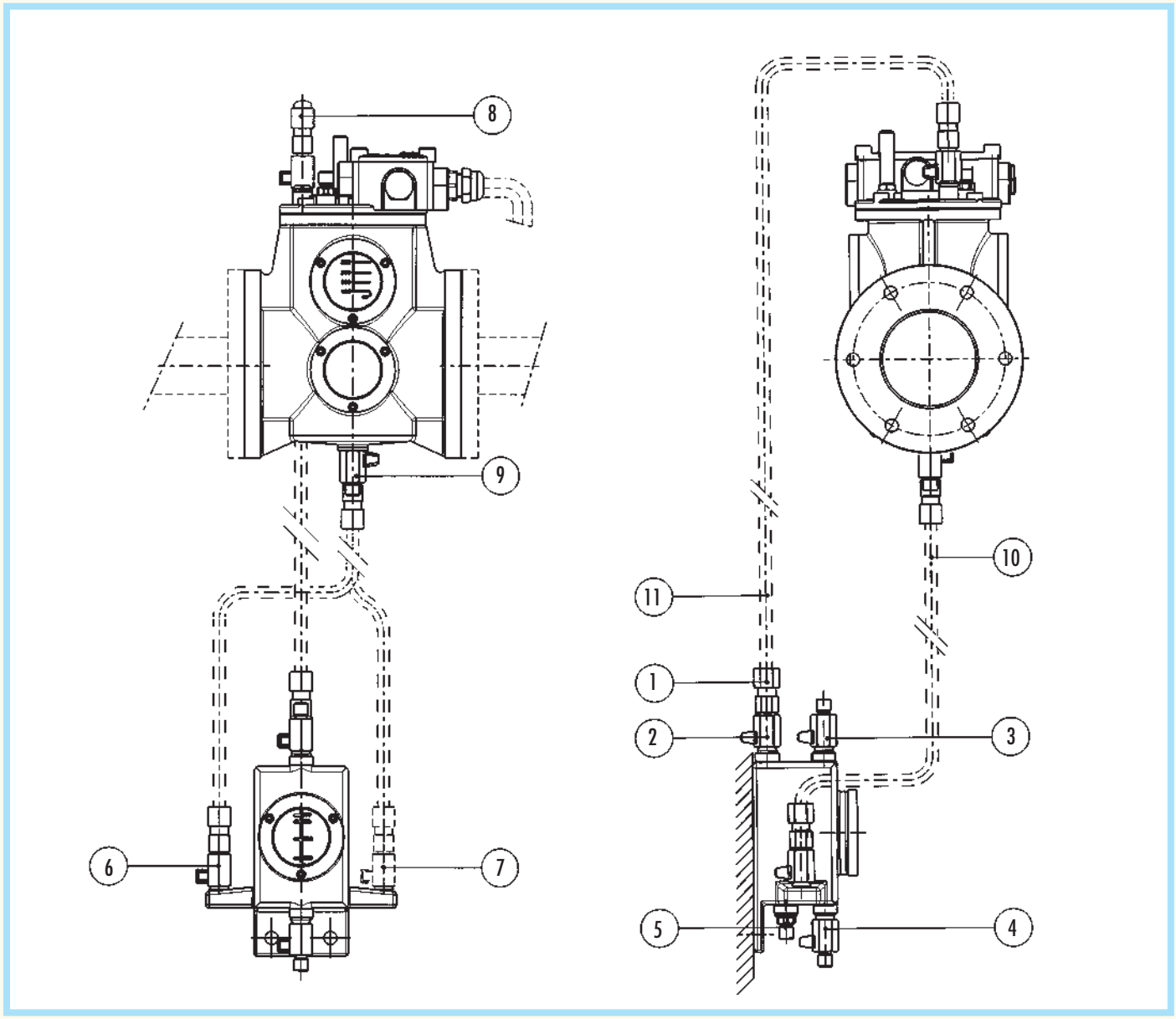


CONSTRUCTION

The Comem gas sampling device is manufactured from an aluminium alloy casting with the following fittings:
- A tempered glass inspection window with graded markings for volume indication.
- A gas sampling valve (2).
- A bleed valve (3).
- A gas inlet valve for pneumatic testing (5).
- A valve for draining oil from the relay (this can be mounted on the right or left hand side of the body (6) or (7).

As a routine test all castings are tested by injecting ambient air at 2.5 bar for 2 minutes.
A certificate to this effect is supplied with the unit.

For the sake of standardisation the device is fitted with the left and right hand valve supports but only one valve.
Customer can then choose which side he prefers.
- With fittings for outside dia. 10 tubes, code **1RDPG00005** (standard);
- with fittings for outside dia. 6 tubes, code **1RDPG00006** (on request);
- with fittings for outside dia. 8 tubes, code **1RDPG00007** (on request).



DESCRIPTION OF OPERATION

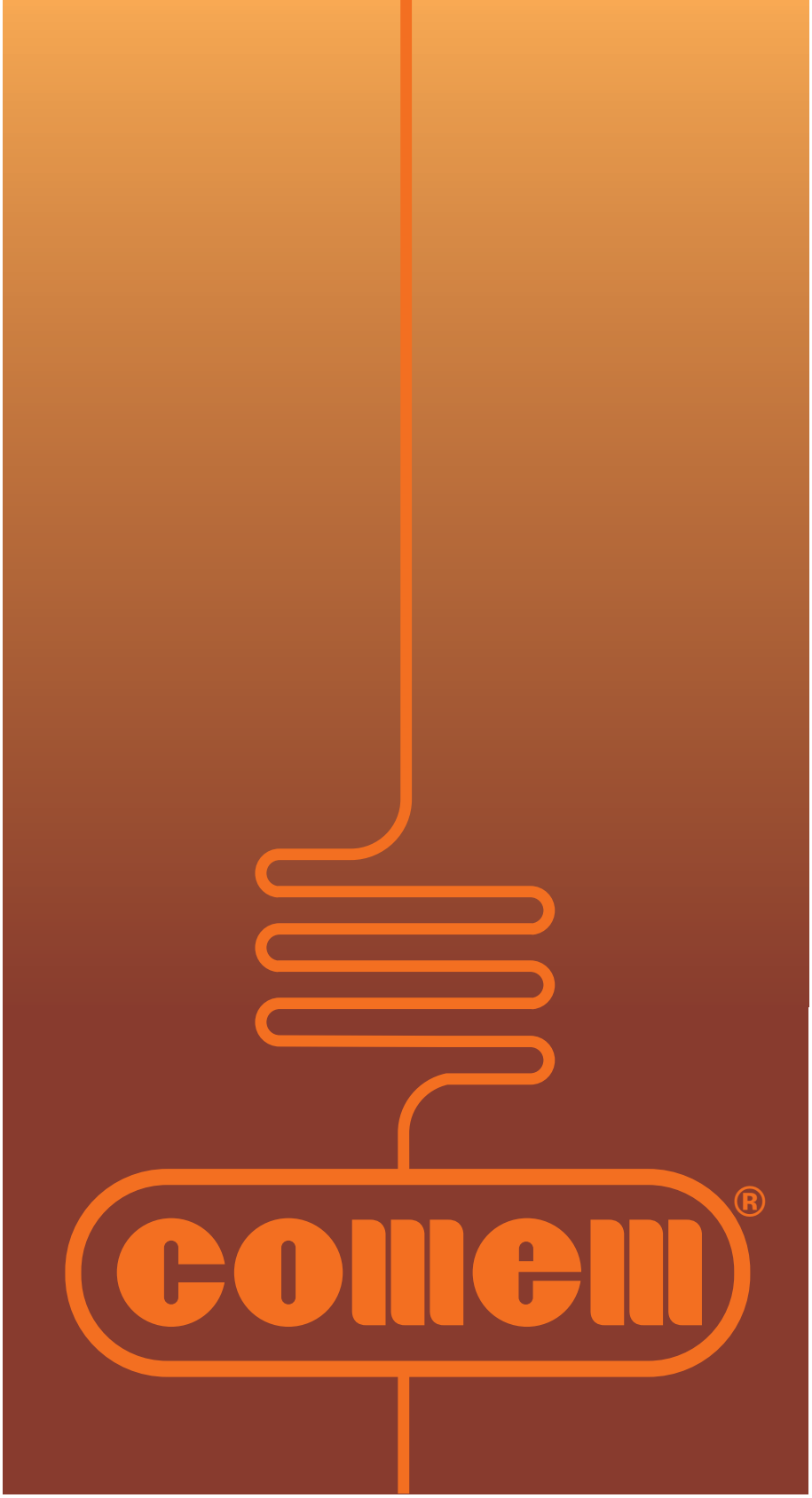
During normal operation the Buchholz relay is full of oil and is connected to the gas sampling device via pipelines 10 and 11.
Valves (8), (2) and (9) are open.
Valves (3), (4), (6) or (7) are closed.
The gas sampling device is consequently also full of oil.
Sampling procedures are as follows:
A- To sample oil: open valve (6) or (4).

B- To sample gas if the relay has signalled alarm or tripped the transformer:
Open valve 4 and let the oil in the device flow out. This draws any gas from the relay via valve (8), tube (11) and valve (2) into the body of the gas. The progress of this operation can be checked through the inspection window. When the desired amount of gas has been collected close valves (2) and (4) and open valve (3) to take the sample.

C- To test satisfactory operation of the alarm and trip circuits proceed as follows:
Close valve (2) then drain all the oil from the device by opening valves (3) and (4). Attach an air pump (bicycle pump) or kit from Comem 5400806002) to valve (5). Close valves (3) and (4) and pump fast whilst simultaneously opening valve (2). The air will then pass into the upper chamber of the Buchholz relay via pipeline (11) lowering the floats and consequently closing their contacts. If you wish to test the lower float then first the valve between the relay and the conservator must be closed to prevent air from flowing directly into the conservator.

OPERATION STARTING

Caution: After commissioning ensure the Buchholz relay and the sampling device are both filled with oil.



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SECTION 9

APPENDIX C

PRESSURE RELIEF DEVICE:
ABB/COMEM 50M

(MANUFACTURER DETAILS - 8 PAGES)

Pressure Relief Device - M

COMEM "M" pressure relief devices are used to control pressures inside tanks. They are used where accidental, instantaneous and uncontrolled increases in pressure may create the danger of explosion. They are designed to discharge the pressure increases that have taken place to the exterior in a very short time period (a few thousandths of a second).
They are widely used in the metal tanks of oil-cooled electric transformers. Sudden and violent short circuits inside these tanks, in fact, instantly generate an enormous amount of gas with a great increase in interior pressures. If the pressure cannot discharge to the exterior there is danger that the transformer may explode, with all the possible harm and damages this may cause. This danger can be prevented by installing one or more pressure relief device with discharge sizes proportional to the volume of oil contained in the transformer. It is always good practice to install these pressure relief devices in all situations where internal pressure values must not exceed specific safety limits.

M

They are widely used in large distribution transformers and traction transformers.

Total pressure relief completely opening

Pressure relief device opening is total each time the pressure relief device operates for pressure settings between 20 and 90 kPa. The discharge opening area, for each pressure relief device operation, is equal to that for higher pressure settings even when pressure settings are lower than 20 kPa. If, however, pressures are generated inside the tank that are much higher than the setting then the spring, further compressed, allows the closing disk to create even larger discharge areas when it operates.

Operating performance

Nominal operating pressure: the pre-fixed overpressure value shall be agreed between supplier and purchaser within the standard range from 20 up to 90 kPa, with 10 kPa steps, with a tolerance of - 5 kPa to + 7 kPa. For model 50M the standard operating pressure range comes up to 200kPa, with 10kPa steps.

Construction

Our pressure relief devices are totally protected against external corrosion and against penetration of foreign bodies between cover and protective cap. This ensures perfect operating efficiency even for extended periods of time.

"M" pressure relief device

These consist of a flanged body and a corrosion-proof aluminium alloy disk. A brass rod that holds the spring is applied to the central part of the disk. There are two gaskets in the pressure relief device: a special shaped upper gasket and a lip seal.
When the pressure relief device is closed the upper gasket is pressed against the disk. The shape of the gasket permits a perfect seal even if the disk lifts 1-2 mm. The disk also makes a seal against the lip seal gasket as it moves upwards. If, due to interior pressure, the disk rises beyond this amount then the upper seal is no longer maintained while the lip seal remains.

At this instant the surface of the washer invested by internal pressure is multiplied in area as is the total force applied on the spring. This causes total and instantaneous opening of the pressure relief device which consequently discharges excess pressures to the exterior.
When pressure has been discharged the disk, pushed back by the spring, lowers down and closes the valve. As the disk moves downwards it first closes against the side gasket and then against the upper gasket.
This latter gasket, because of its special shape, is pressed down 1- 2 mm. and the disk moves further down, breaking the seal on the lip seal gasket. This releases any pressure that may have been trapped between the two gaskets. Now the pressure relief device is ready to work.

Routine tests

It is necessary to carry on operational tests, with compressed air:

- to check the correct functioning of the device at operating pressure values
- to check the functioning of the optic signal and of the electric contacts.

Installation guidelines

Our "M" pressure relief devices come in 2 sizes and have different discharge areas. This allows users to select the type that is best suited for the volume of oil contained in the tank. The following table gives guideline values:

Volume of oil tank:	Type of pressure relief device
up to 3000 dm^3	50 M*
up to 25000 dm^3	125 M*

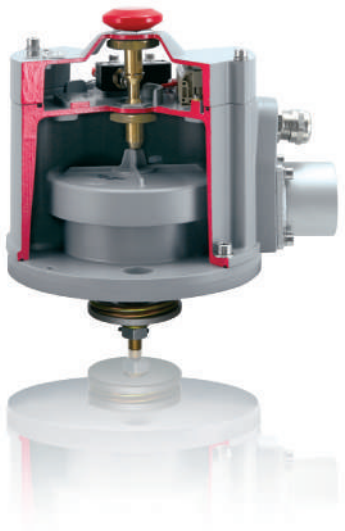
* These guideline sizes are based on experience.

We recommend using multiple pressure relief devices when oil volumes exceed these levels. It is always good practice to use multiple pressure relief device with smaller discharge areas rather than a single pressure relief device with a large area. The reason for this, in the case of transformers, is that it is better to install one pressure relief device above each winding column since these are the points where maximum interior pressures are generated in case of a short circuit. Instantaneous pressure relief device opening implies direct contact between the closing disk and oil. For this reason the pressure relief device are equipped with a screw to bleed out air that may accumulate during oil tank filling procedures.

Oil tightness duct

It is a good practice to prevent harm to persons or property from violent jets of hot oil evacuating from the pressure relief device, for pressure relief device discharges to be ducted towards points properly designed to receive the hot oil. The protection of the environment is also another important target which has to be pursued by everybody. Our protection duct allows to drain the oil evacuated by the pressure relief device. The perfect hydraulic tightness of the system guarantees that not any drop of oil is dispersed in the environment, but collected through a pipe in a tank (pipe and tank are not supplied). The sealing oil duct is made of die-casted aluminium; a terminal flanged tube made of steel is also provided if someone wants to weld the pipeline. O-ring gaskets have been adopted for the duct sealing. Detailed assembling instructions are supplied with the equipment.

Pressure Relief Device - M



Visual signal that the pressure relief device is open

Pressure relief devices are equipped with a visual signal that shows when they have opened. This signal consists of a red knob that protrudes from the central part of the duct when the pressure relief device has opened. Just press it down in order to make it go back to its normal position and reset the switches, too.

Electrical signalling switch

Maximum 3 "pressure relief device open signal" contacts can be mounted on request. These are a fast tripping limit switch with switching contact contained inside a watertight room IP 65. The contacts simultaneously act with the visual signal.

The switches have the following characteristics:

Specifications:

Breaking and making capacity (NO and NC contacts)		
Voltage	**Uninterrupted current (making capacity)**	**Interrupted current (breaking capacity)**
24 VDC to 220 VDC	2 A	100 mA L/R<40 ms
230 VAC	2 A	2 A cos φ>0.5

Other characteristics:

- The pressure relief device is supplied with a "locking system" which allows the pressure relief device to be blocked during the transformer oil leakage test. The locking system has been tested to withstand max 2 bar pressureand can also be used during the transformer transport.
  WARNING!: the locking system must be removed before powering-up the transformer.
- The pressure relief device is supplied with a M25x1.5 cable gland.
- Colour: RAL 7001.

Outer surface protection

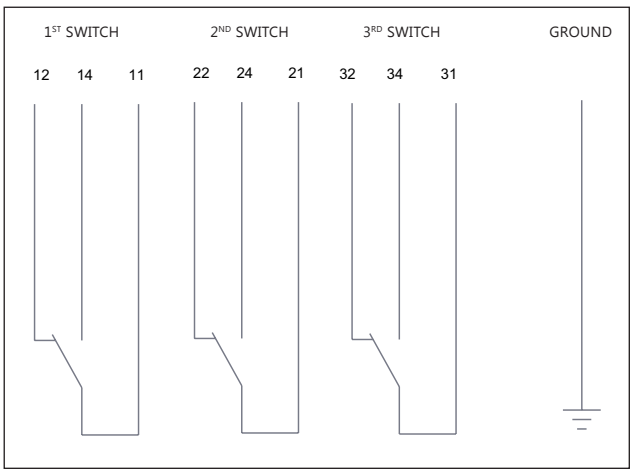
External surfaces are protected against weather corrosion. Aluminum alloy components are non-corroding and their surfaces are protected with a double layer of paint offering high level protection against all atmospheric agents and resisting temperature variations between -40 °C and +100 °C. Special painting for severe climate applications is also available on request.

Contact diagram

- FIRST SWITCH (terminals 12-14-11)
  change-over contact:
  – 14-11 normally open
  – 11-12 normally closed

- SECOND SWITCH (terminals 22-24-21)
  change-over contact:
  – 23-21 normally open
  – 21-22 normally closed

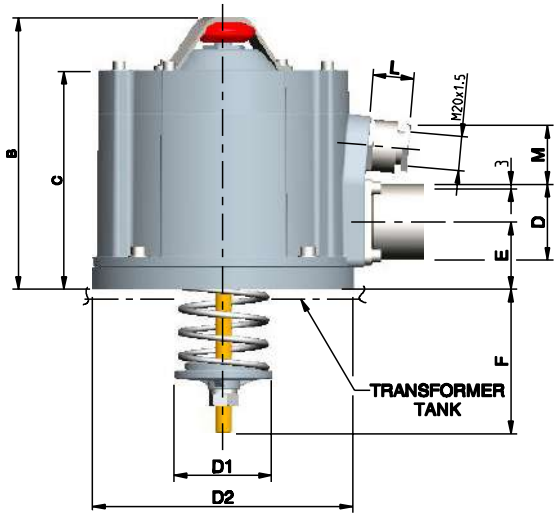
- THIRD SWITCH (terminals 32-34-31)
  change-over contact:
  – 34-31 normally open
  – 31-32 normally closed

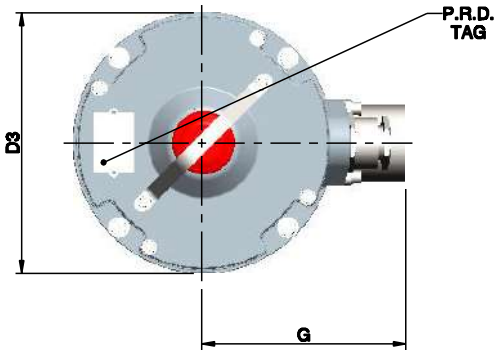


Pressure Relief Device - M

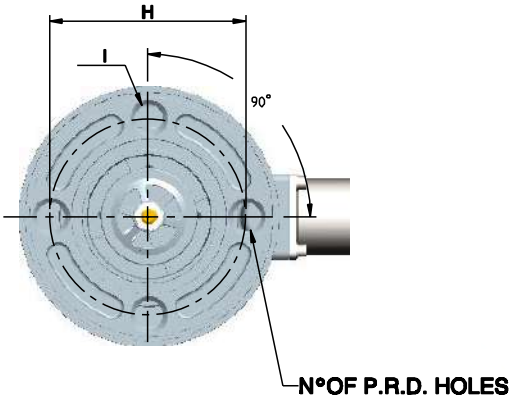
Overall dimensions

Type 50M





50M

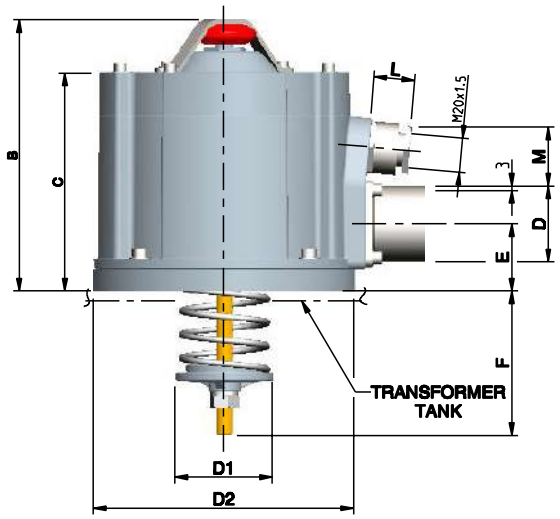


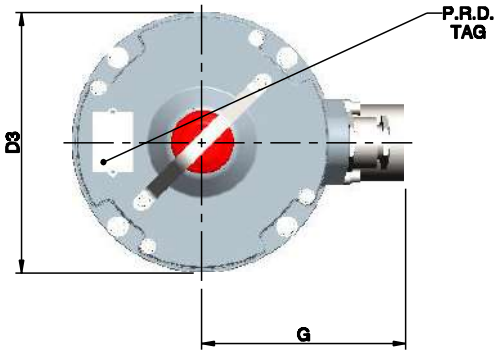
Type	B	C	D	D1	D2	D3	E	F20KPA *	F70KPA *	G	H	I	L	M	kg
50 M	170	139	Ø48.3	Ø62	Ø165	Ø166	41.5	95	60	130	Ø125	Ø18	23	38	2.1

* F = the dimension varies with set pressure

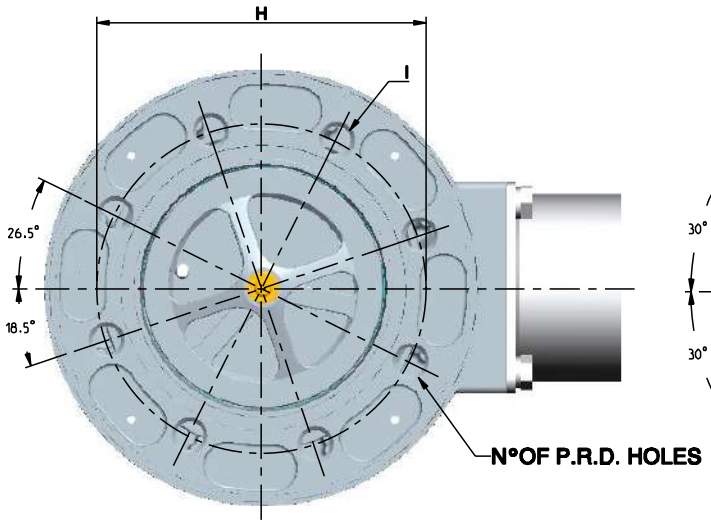
Overall dimensions

Type 125 M8 and 125 M6

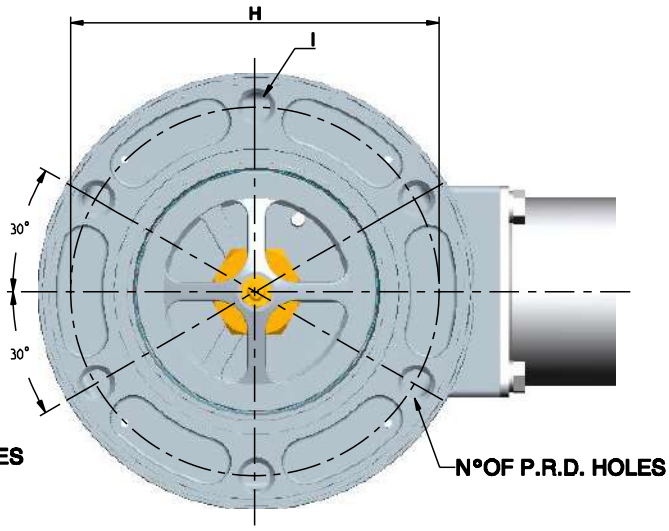




125M-8



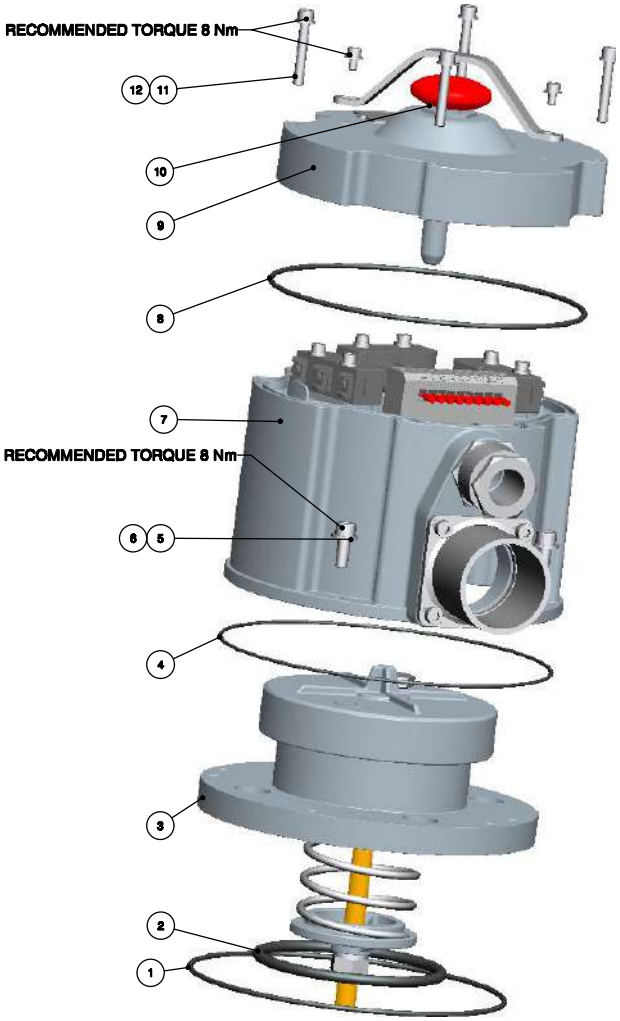
125M-6

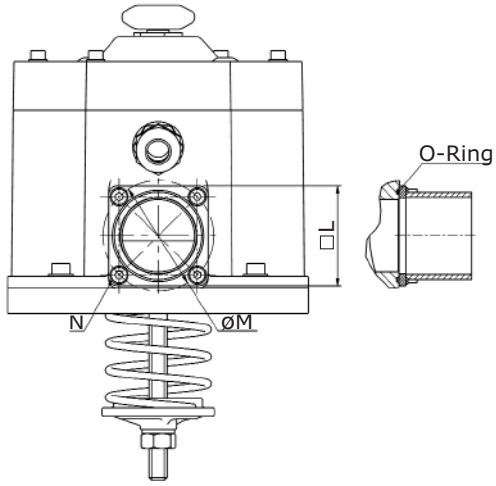


Type	B	C	D	D1	D2	D3	E	F20KPA	F70KPA	G	H	I	No. of holes
125 M-8	278	228	Ø120	Ø153	Ø278	Ø278	86	175	80	230	Ø210	Ø18	8
125 M-6	278	228	Ø120	Ø153	Ø278	Ø278	86	175	80	230	Ø235	Ø18	8

Pressure Relief Device - M

Assembling sequence





Type	□L	ØM	N	O-Ring
50 M	55	61	4 Screws M5x12	5G0D002187
125 M-8	135	152	4 Screws M12x25	5G0D004475
125 M-6	135	152	4 Screws M12x25	5G0D004475

Type 50 M

Ref.	Q.ty	Code	Description
1	1	5G0D003600*	GASKET O.R. 3600
2	1	5G0D000183*	GASKET O.R. 6337
3	1	-	50M SAFETY VALVE
4	1	5G0D002637	GASKET O.R. 2637
5	1	5V51106012	UNI 5931 M6X12 FIXING SCREW
6	1	5400800861	WASHER
7	1	-	OIL DUCT 50M
8	1	5G0D003600	GASKET O.R. 3600
9	1	-	OIL DUCT COVER 50M
10	1	-	VISUAL SIGNAL
11	1	5V50605035	UNI 5931 M5X35 FIXING SCREW
12	1	5RG0600050	WASHER

Type 125 M-8

Ref.	Q.ty	Code	Description
1	1	5G0D041050**	GASKET O.R. 41050
2	1	5G0L000227**	GASKET O.R. 8650
3	1	-	125M-8 SAFETY VALVE
4	1	5G0D041050**	GASKET O.R. 41050
5	1	5V50606060	UNI 5931 M6X60 FIXING SCREW
6	1	5400800861	WASHER
7	1	-	OIL DUCT 125M
8	1	5G0D041100	GASKET O.R. 41100
9	1	-	OIL DUCT COVER 125M
10	1	-	VISUAL SIGNAL
11	1	5V50605035	UNI 5931 M5X35 FIXING SCREW
12	1	5RG0600050	WASHER

Type 125 M-6

Ref.	Q.ty	Code	Description
1	1	5G0D041050**	GASKET O.R. 41050
2	1	5G0L000227**	GASKET O.R. 8650
3	1	-	125M-6 SAFETY VALVE
4	1	5G0D041050**	GASKET O.R. 41050
5	1	5V50606060	UNI 5931 M6X60 FIXING SCREW
6	1	5400800861	WASHER
7	1	-	OIL DUCT 125M
8	1	5G0D041100	GASKET O.R. 41100
9	1	-	OIL DUCT COVER 125M
10	1	-	VISUAL SIGNAL
11	1	5V50605035	UNI 5931 M5X35 FIXING SCREW
12	1	5RG0600050	WASHER

* ALTERNATIVE PLANE GASKET CODE 5C0V412501
** ALTERNATIVE PLANE GASKET CODE 5C0V452900

Order sheet

Number of pieces			
Model	50 M ☐	125 M-8 ☐	125 M-6 ☐
Contacts	**1** ☐	**2** ☐	**3** ☐
Pressure setting 20÷90 kPa Up to 200kPA for 50M only	Value ..... kPa		
For use in:	Moderate salinity areas acc. to ISO 12944 ☐		
	Off-shore areas acc. to ISO 12944 ☐		
Gaskets type	Viton ☐	silicone oils and/or high temperature -10°C up to + 150°C	
	NBR -40°C ☐	mineral oils and low temperature -40°C up to + 120°C	

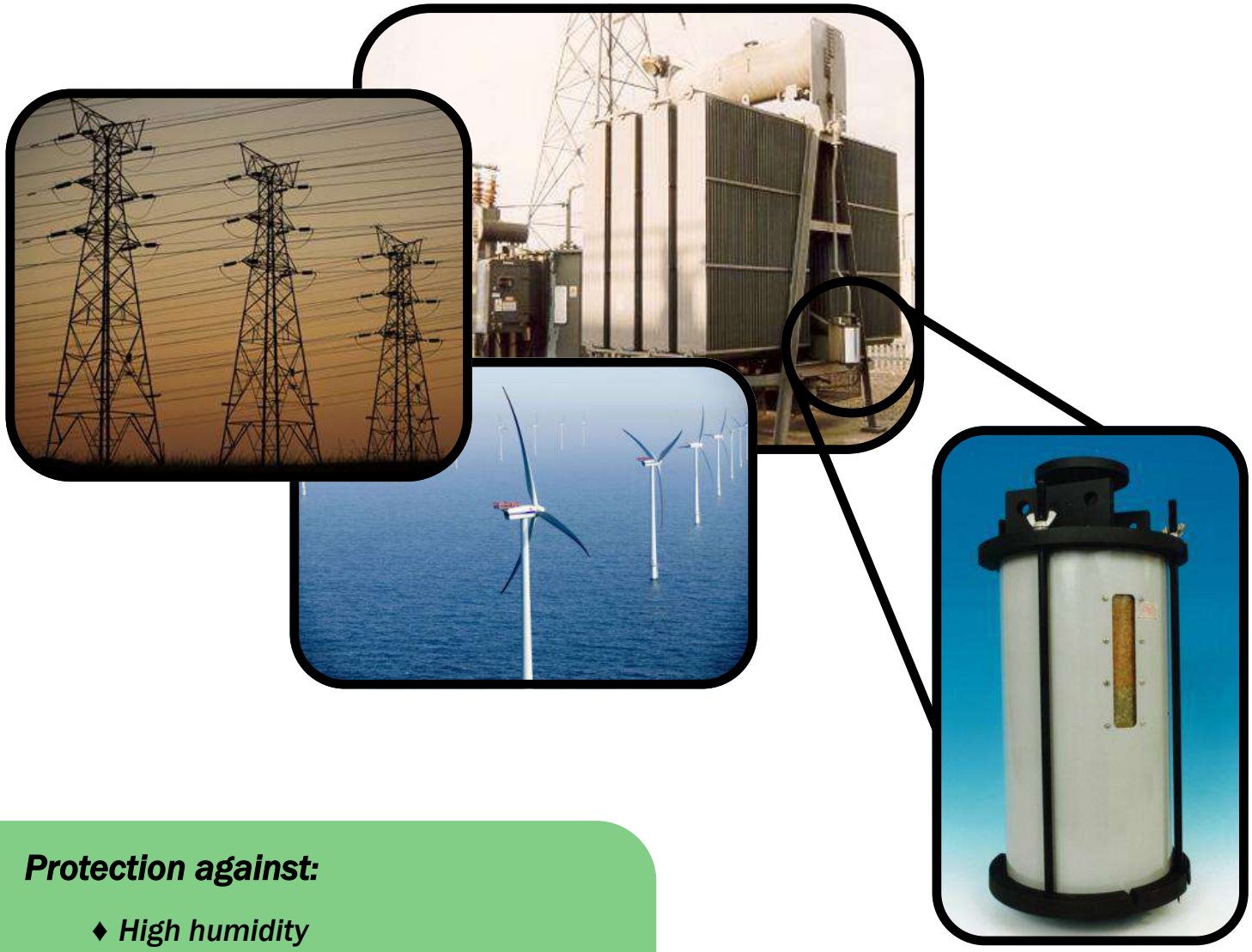
SECTION 10

DEHYDRARTING BREATHER: BROWNELL TYPE R1

(MANUFACTUR DETAILS - 5 PAGES)
(FITTING INSTRUCTIONS - 2 PAGES)
(SAFETY DATA SHEETS - 11 PAGES)

APPENDIX D

Transformer Breathers



Protection against:

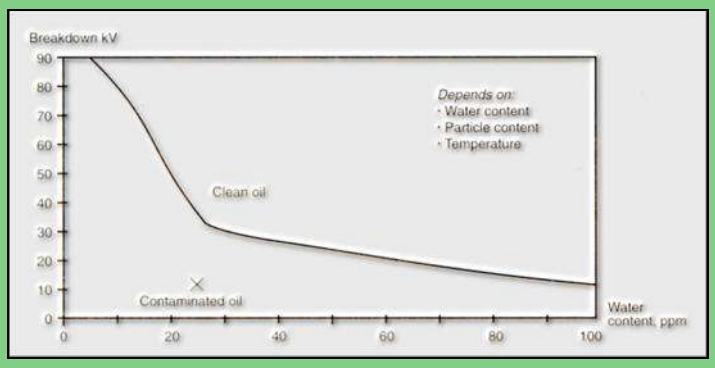
- *High humidity*
- *Water condensation*
- *Pressure variations*
- *Dielectric loss*
- *Mould growth*
- *Outgassing*

Key Technical Features

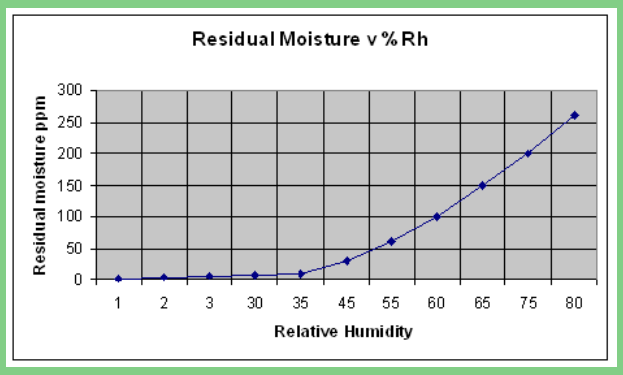
- High performance plastic or metal construction
- Simple installation
- ISO9001/2008 design approved
- Suitable for 1250 kVA to 750 mVA Transformers
- Low dusting beaded ENVIROGEL adsorbent
- Up to 25% adsorption capacity
- Definitive colour change saturation indication
- IP 65 rating
- Operating temperature range –50°C to +70°C
- Vandal proof
- Weather resistant
- All round visual saturation indicator

Size R Transformer Breather

Typical Electrical Breakdown in Transformers



The insulation value of oil can deteriorate dramatically as it becomes contaminated with water.



Water content of oil increases as it is exposed to high relative humidity

Rechargeable Transformer Breathers

V, W Transformer Breathers

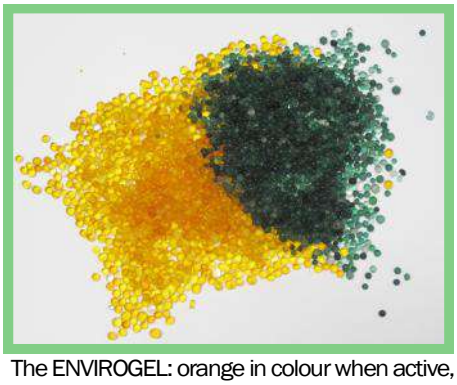
Robust construction Transformer Breathers

BROWNELL Transformer Breathers provide clear visibility of the ENVIROGEL through a shatter-proof, UV stabilised polycarbonate cylinder or window.

Two-way, low pressure valves are fitted in the base of the breather, to ensure that atmospheric air enters the desiccant charge when a negative pressure differential occurs within the transformer being protected.

BROWNELL Transformer Breathers are filled with ENVIROGEL, self-indicating desiccant.

The ENVIROGEL is orange in colour when active, turning green when saturated. This allows a visible assessment of the condition of the ENVIROGEL. Various sizes and packs of ENVIROGEL are available for refilling the Transformer Breathers.



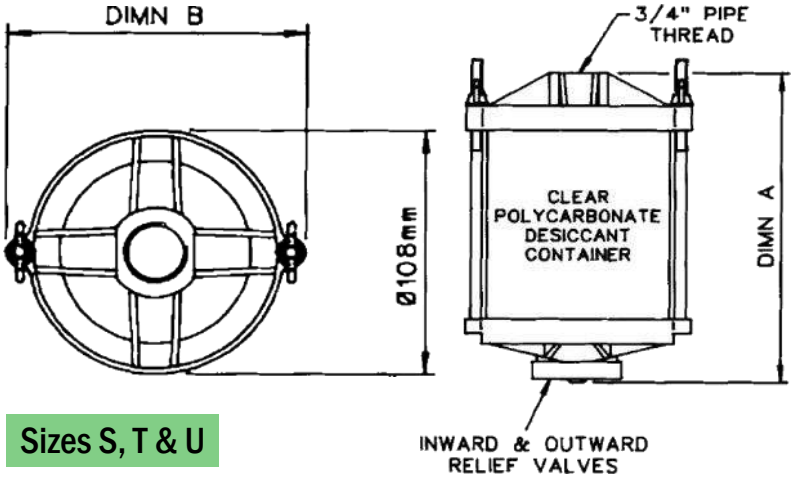
The ENVIROGEL: orange in colour when active, turning green when saturated

BROWNELL have more than 40 years experience in the design, manufacture and testing of types of humidity control equipment and moisture measuring instruments.
Please contact our Technical Services Division for further information.

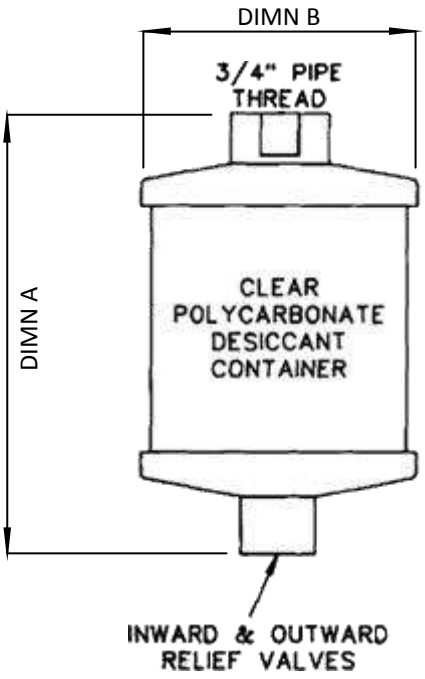
Sizes R, R1, R2, S, T & U

The top pipe connector (3/4" Female Pipe Thread) is also the filling and emptying point. The beaded, self-indicating ENVIROGEL should be replaced once the colour has changed from orange to green, as indicated on the label attached to the breather. All threads conform to BS21 and ISO7-1. Full installation and maintenance instructions are supplied with each BROWNELL Transformer Breather.

Size	Max. Oil Contents	Weight of Desiccant	Overall Length (A)	Overall Diameter (B)
R	1500 Litres	0.60 Kg	158mm	108mm
R1	3000 Litres	1.20 Kg	260mm	108mm
R2	4750 Litres	1.90 Kg	362mm	108mm
S	1130 Litres	0.45 Kg	170mm	127mm
T	2250 Litres	0.90 Kg	270mm	127mm
U	4500 Litres	1.80 Kg	470mm	127mm



Sizes S, T & U



Sizes R, R1 & R2

Quick Change

- ENVIROGEL cartridges can be refilled, replaced or reactivated
- Rapid cartridge replacement
- No special tools required
- Minimum downtime and maintenance
- Ideal for planned maintenance cycles

Transformer Breathers can be changed in a matter of minutes with Brownell's replacement cartridges. (Size W illustrated)

FAQs

Q: Can I fit a Transformer Breather, which has a larger ENVIROGEL capacity than my existing Transformer Breather?
A: Yes, for example you can use a Size R1 Transformer Breather to replace an R type which will significantly increase the time between ENVIROGEL maintenance.

Q: Are there any specific safety considerations when handling Transformer Breathers and ENVIROGEL?
A: We recommend when handling ENVIROGEL, suitable precautions are taken (as with any potentiality dust generating material) an approved respiratory mask is used.

Q: What is the recommended method for disposing of used ENVIROGEL?
A: We suggest that used ENVIROGEL is disposed of at a registered landfill site in accordance with local authority regulations.

Q: How can I reactive saturated ENVIROGEL?
A: Following the safety procedures for handling ENVIROGEL. Heating the ENVIROGEL for 3-4 hours at 95°C will recover 95% of the adsorption capacity.

INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS

FOR BLD9662/01-3 TRANSFORMER BREATHERS

Description

The S, T & U Transformer Breathers consist of a top moulding with metal adaptor, a refillable desiccant container with stainless steel guard and a bottom moulded assembly which houses the inlet and outlet relief valve. All items are clamped together by two-threaded tie rods.

Installation

The Breather is supplied with a threaded sealing plug, which is fitted into the atmosphere air inlet on the top moulding. This is to prevent any water vapour ingress whilst in store. This plug should be removed immediately prior to the top moulding (with adaptor) being screwed to the air vent pipe of the equipment. The thread size of the metal adaptor on the top moulding of the breather is ¾ inch BSPP Female. When fitting the breather to the transformers pipe it should only be fitted by the metal adaptor, the transformer breather must not be twisted from the body or the supporting tie rods as this will damage the end mouldings.

The breather is now ready to use.

Since the change from oil seal bowls to relief valves no other work is involved in the installation as the valves prevent any water vapour ingress from the atmosphere.

Operation

Periodic inspection should be carried out to monitor the condition of the desiccant charge. The breathers are charged with ENVIROGEL desiccant. This material changes in colour from orange to green as it becomes saturated with water vapour. When the colour change reaches the indicator line on the label on the desiccant container, it should be re-charged with fresh ENVIROGEL.

Desiccant

All Brownell transformer breathers are filled with non carcinogenic silica gel called ENVIROGEL. For more information about ENVIROGEL go to www.envirogel.co.uk

Maintenance

The only maintenance necessary to keep the breather in a fully active condition is the replacement of the spent desiccant as follows:

1. Loosen the wing nuts on the tie rods until the desiccant container and guard can be removed from between the top and bottom mouldings.
2. Remove the top perforated cover and empty the spent desiccant from the container. This material may be disposed of in a normal landfill site.

3. Fill the container with active Envirogel desiccant (Refills of the correct grade and quantity are available from Brownell Limited). Lightly tap the container to settle the desiccant and top up if necessary.

4. Replace the perforated cover and refit the container between the top and bottom mouldings and guard ensuring that it is correctly fitted between the sealing gaskets.

5. Screw the wing nuts home, being careful not to over tighten as this can distort the moulding.

NOTE: If it is necessary to replace the complete desiccant container, instead of re-charging the existing unit, ensure that the self-adhesive aluminum foil vapour barriers are removed from the top and bottom of the container before installation.

DESICCANT REFILLS

	Size S	**Size T**	**Size U**
Refill Part No.	BL/D6750/01	BL/D6750/02	BL/D6750/03
Complete Desiccant Container Part No.	BL/D6437/01	BL/D6437/02	BL/D6437/03

As indicated above, individual refills containing sufficient Envirogel desiccant of the correct grade and volume are available. This method of supply is recommended to users who have a limited requirement.

As an alternative to individual refills for users who have a regular requirement, 25, 50 & 125kg sealed drums of the correct grade and size of desiccant are available.

It must be emphasised, however, that careful housekeeping is necessary when dispensing desiccant from bulk containers.

Ensure that the container is open for the minimum time necessary to remove the required quantity and that is properly sealed immediately after use.

Please contact our technical Support Division on 020 838 8408 or 020 8965 9281 for further information and guidance if required.

BROWNELL
LIMITED

Unit 2, Abbey Rd Industrial Park
Commercial Way, Park Royal
London, NW10 7XF

Tel**: 020 8965 9281** Fax: **020 8965 3239**

E-Mail: info@brownell.co.uk
Website: www.envirogel.co.uk
Website: www.tankventdryer.com

The Friendly ENVIROGEL Adsorbent

Safety Data Sheet

According to Regulation (EC) No 1907/2006 (REACH)

Trade Name: Brownell Limited
Product: Self-Indicating Silica Gel, Orange to Green
Version No: MCS/101/01/MSDS - 06 / EN

Revision Date: 03.01.2017
Print Date: 03.01.2017

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name or designation of the mixture	Self-Indicating Silica Gel, Orange to Green
Registered number	Not available
Synonyms Issue	Silica, amorphous, silica, precipitated and gel
Date Version	12th May 2014
Number Revision	06
Date Supersedes	03rd January 2017

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	Desiccant. For adsorption of moisture and prevention of corrosion and mould growth
Uses advised against	No other uses are advised

1.3 Details of the supplier of the safety data sheet

Supplier Name	Brownell Limited
Address	Unit 2, Abbey Road Industrial Park, Commercial Way Park Royal London NW10 7XF
Country	UK
Telephone	+44 (0) 208 965 9281
Fax	+44 (0) 208 965 3239
Email	info@brownell.co.uk
Contact	Robert Beasley
Website	www.brownell.co.uk

1.4 Emergency telephone number

+44 (0) 20 8838 8408 – (08:00 – 17:00) office hours

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

The mixture has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Regulation (EC) No. 1272/2008 as amended
This substance does not meet the criteria for classification according to the Regulation (EC) 1272/2008 as amended.

Physical hazard	Not classified as a physical hazard.
Human health hazard	Not classified as a health hazard.
Environmental hazard	Not classified as an environmental hazard.

Addition information Repeated exposure may cause skin dryness or cracking.
Exposure to powder or dusts may be irritating to eyes, nose and throat.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 [CLP/GHS]

Product identifier Not applicable
Hazard statements Not applicable
Precautionary statements Not applicable
Supplemental hazard information Not applicable
Special rules for supplemental label elements for certain mixtures Not applicable
Additional labeling Not applicable

2.3 Other hazards Not applicable

SECTION 3: Compostition/information on ingredients

3.1 Substances

Substance name	Silica Gel (Silicon Dioxide) >98%	Methyl Violet <0.2%	Water <2%
Index No	-	-	-
EC No	231-545-4	208-953-6	231-791-2
REACH No	JT211170-39	-	-
CAS No	(12926-00-8) 7631-86-9	548-62-9	7732-18-5

Purity Not Applicable
Synonyms Silica, amorphous; silica, precipitated and gel.
Stabilisers Not Applicable
Hazard Impurities Not Applicable

3.2 Mixtures Not applicable
Additional information This mixture does not contain further substances fulfilling the criteria of hazard class “acute toxicity” according to CLP regulation.

SECTION 4: First Aid measures

General information If exposed or concerned, get medical advice/attention. Show this safety data sheet to the doctor in attendance.

4.1 Description of first aid measures

Inhalation If dust from the material is inhaled, remove the affected person immediately from the source of exposure to fresh air, seek medical attention if symptoms develop or persist.

Skin contact	Wash spillage from skin with soap and water, seek medication attention if irritation develops and persists.
Eye Contact	Do not rub eyes. Rinse with water, seek medical attention if irritation develops and persists.
Ingestion	Rinse out mouth with water thoroughly; seek medical attention if symptoms occur. If ingestion of a large amount does occur, seek medical attention.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms	Dust may irritate the respiratory tract, skin and eyes.

4.3 Indication of any immediate medical attention and special treatment needed

Notes for the doctor	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	Any media suitable for the surrounding fire.
Unsuitable extinguishing media	Not applicable and unused material will not burn.

5.2 Special hazards arising from the substance or mixture

Hazardous combustion products	Inorganic compound, not combustible and is not considered to be a fire hazard.

5.3 Advice for firefighters

Additional information	Special protective equipment for fire-fighters - Full protective clothing must be worn in case of fire and appropriate breathing equipment for surrounding fire.

SECTION 6: Accidental release measure

6.1 Personal precautions, protective equipment and emergency procedures.

For non-emergency personnel

Protective equipment	Avoid inhalation of dust from the spilled material. Wear a dust mask if dust is generated above exposure limits. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation.
Emergency procedures	Keep unnecessary personnel away.

6.2 Environmental precautions No special precautions.

6.3 Methods and materials for containment and cleaning up

For containment	Contain spillage, collect material using a vacuum cleaner equipped with HEPA filter and collect in suitable container for disposal.
For cleaning up	Large Spills: Wet down with water and pile for later disposal. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage to avoid the generation of dust during clean-up and collect in suitable container for disposal.

6.4 Reference of other sections

Additional information	For personal protection, see section 8 of the SDS. For waste disposal, see section 13.

SECTION 7: Handling and Storage

7.1 Precautions for safe handling

Protective measures	
Advice on safe handling	Wear appropriate personal protective equipment. Do not breathe dust from this material, avoid creating any dust and contact with skin and eyes as this may cause irritation.
Fire preventions	During handling electrostatic charges can accumulate, therefore static electricity and formation of sparks must be prevented, use proper bonding and/or grounding procedures.
Aerosol and dust generation preventions	Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed.
Environment precautions	No special environmental precautions required.
Advice on general occupational hygiene	Observe good industrial hygiene practices.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures and storage conditions	Suitable for any general chemical storage area. Provide appropriate exhaust ventilation at places where dust is formed.
Packaging materials	Keep all material in an air-tight container, material is hygroscopic.
Requirements for storage rooms and vessels	All containers must be kept in a dry, cool place. Store in a well-ventilated place.
Hints on storage assembly:	
Storage class	Not Available
Materials to avoid	Not Applicable

7.3 Specific end uses

Recommendations	Not applicable
Specific end uses	The specified uses for this material are shown in section 1 of the document.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

8.1.1 Occupational exposure limits**:**
UK. EH40 Workplace Exposure Limits (WELs)

Substance Name	EC-No.	CAS-No.	Type	Value	Occupational exposure limit value	
					Long Term	Short Term
Silica, Amorphous – Inhalable dust	231-545-4	(12926-00-8) 7631-86-9	TWA	OES 6mg/m^3	8 Hours	-
Silica, Amorphous – Respirable dust	231-545-4	(12926-00-8) 7631-86-9	TWA	OES 2.4mg/m^3	8 Hours	-
Silica gel	231-545-4	(12926-00-8) 7631-86-9	TWA	ACGIH: TLV 10mg/m^3	8 Hours	-
Methyl Violet	208-953-6	548-62-9	TWA	ACGIH: 0.5mg/m^3	8 Hours	-

8.1.2 Biological limits values No biological exposure limits noted for the ingredient(s).

8.1.3 Exposure limits at intended use Not applicable

8.1.4 DNEL/PNEC-values DNEL / PNEC < 1 = No immediate concern

8.1.5 Risk management measures according to used control banding approach Not applicable

8.2 Exposure controls

8.2.1 Appropriate engineering controls: Engineering methods to prevent or control exposure are preferred. Methods include process or personnel enclosure, mechanical ventilation (dilution and local exhaust) and control of process conditions.

8.2.2 Personal protective equipment

Eye / Face protection:
Suitable eye protection Wear suitable eye protection (safety glasses with side shields).

Skin protection:
Hand protection Suitable gloves can be recommended by the glove supplier.
Body protection Wear lab coat over normal work clothing (long sleeved shirts and long pants) is recommended.

	Respiratory protection	Avoid inhalation of dust. Wear suitable respiratory protection equipment if working in confined spaces with inadequate ventilation or whenever there is any risk of the exposure limits being exceeded.
	Thermal hazards	None known
8.2.3	**Environmental exposure controls**	None known

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance:
Physical state: Solid beads **Colour:** Dry: Yellow/Orange Saturated: Green **Odour:** Odourless

pH	2-10 (5% Aqueous Solution)
Melting Point	>1000°C
Boiling Point	Not Applicable
Flash Point	Not Applicable
Evaporation rate	Not available
Flammability (solid, gas)	Non-flammable
Upper/lower flammability or explosive limits	
Upper explosive limits	Not Applicable
Lower explosive limits	Not Applicable
Vapour pressure	Not available
Vapour density	Not available
Relative density	2.1 (water = 1)
Solubility(ies)	Less 1.0% in weight
Partition coefficient: n-octanol/water	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Viscosity	Not available
Viscosity, dynamic	Not available
Viscosity, cinematic	Not available
Explosive properties	Not available
Oxidising properties	Not available

9.2 Other information:

Physical hazards	
Explosives:	Not available
Flammable gases:	Not applicable
Flammable aerosols:	Not applicable
Oxidising gases:	Not available
Gases under pressure:	Not available

Flammable liquids:	Not applicable
Flammable solids:	Not applicable
Self-reactive substances and mixtures	Not available
Pyrophoric liquids	Not available
Pyrophoric solids	Not available
Self-heating substances and mixtures	Not available
Substances or mixtures which, in contact with water emit flammable gases	Not available
Oxidising liquids	Not available
Oxidising solids	Not available
Organic peroxides	Not available
Metal corrosion	Not available

SECTION 10: Stability and reactivity

10.1 Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport

10.2 Chemical stability Material is stable under normal conditions and hygroscopic

10.3 Possibility of hazardous reactions No dangerous reaction known under conditions of normal use

10.4 Conditions to avoid Not available

10.5 Incompatible materials Not available

10.6 Hazardous decomposition products No hazardous decomposition products are known

SECTION 11: Toxicological information

11.1 Information on toxicological effects
11.1.1 Substances
Acute toxicity: Animal data

Substance	Effect dose / concentration	Value	Species
Acute oral toxicity	LD50	>15,000mg/kg	Rat
Acute dermal toxicity	LD50	>5,000mg/kg	Rabbit
Acute inhalation	LC50	>0.139mg/1/14h	Rat

Skin corrosion/irritation	No data available
Eye damage/irritation	No data available

Sensitisation to the respiratory tract/skin	No data available
Germ cell mutagenicity	No data available
Carcinogenicity	Amorphous silica is not classifiable as to its carcinogenicity to humans (Group 3).
Reproductive toxicity	No data available
Specific target organ toxicity (single exposure)	No data available
Specific target organ toxicity (repeated exposure)	No data available
Aspiration hazard	Dust may irritate lungs. Amorphous silica is not known to cause silicosis.
Physical, chemical and toxicological characteristics	
In case of ingestion	No data available
In case of skin contact	Dust may have a drying effect on the skin.
In case of inhalation	Synthetic amorphous silica gel has little adverse effect on lungs and does not produce significant disease or toxic effect when exposure is kept below the permitted limits. However existing medical conditions (eg asthma, bronchitis) may be aggravated by exposure to dust. Effects of dust may be greater and occur at lower levels of exposure in smokers compared to non-smokers.
In case of eye contact	Dust may cause discomfort and mild irritation.

11.1.2 Mixtures No data available

SECTION 12: Ecological information

12.1 Toxicity Synthetic amorphous silica is virtually inert and has no known adverse effect on the environment and not toxic to aquatic life

12.2 Persistence and degradability The product solely consists of inorganic compounds which are not biodegradable. The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential Does not bioaccumulate.

12.4 Mobility in soil Insoluble and thus presents a low mobility in most soils.

12.5 Results of PBT and vPvB assessment This substance is not classified as PBT or vPvB according to current EU criteria.

12.6 Other adverse effects No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product / packaging disposal Product can be reactivated in an oven for re-use.

Waste codes / waste designations according to EWC/AVV	The Waste code should be assigned in discussion between the user, the producer and the waste disposal company. This material is not classified as hazardous waste under EEC Directive 91/689/EEC.
Packaging	No data available
Waste treatment options	Disposal of in accordance with all applicable local and national regulations. This material is not classified as special waste under UK Special Waste Regulations 1996 and can be disposed of by landfill at an approved site.
Other disposal recommendations	Dispose in accordance with all applicable regulations.

SECTION 14: Transport information

14.1 UN No.	Not classified as dangerous goods under the United Nations Transport Recommendations.
14.2 UN Proper Shipping name	Not applicable.
14.3 Transport hazard class(es) Hazard label(s)	Not applicable.
14.4 Packing group	Not applicable.
14.5 Environmental hazards	Not applicable.
14.6 Special precautions for user	Not applicable.
14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.
Land transport (ADR/RID)	Not regarded as dangerous goods
Inland Waterway transport (ADN)	Not regarded as dangerous goods
Sea transport (IMDG)	Not regarded as dangerous goods
Air transport (ICAO-TI / IATA-DGR)	Not regarded as dangerous goods

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1 EU regulations

Authorisations:	Not applicable
Restrictions on use:	Not applicable

Other EU Regulations:
Directive 2010/75/EC on industrial emissions
Not listed

Directive 2004/42/CE on the limitation of emissions of volatile organic compounds
Not listed

Regulation (EC) No. 842/2006 on certain fluorinated greenhouse gases
Not listed

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I
Not Listed

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex II
Not Listed

Regulation (EC) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 1 as amended
Not Listed

Regulation (EC) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 2 as amended
Not Listed

Regulation (EC) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 3 as amended
Not Listed

Regulation (EC) No. 649/2012 concerning the export and import of dangerous chemicals, Annex V as amended
Not Listed

15.1.2 National regulations Not Available

15.2 Chemical safety assessment No Chemical Safety Assessment has been carried out.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes

Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

SECTION 16: Other information

16.1 Indication of changes

MSDS first issued	18th April 2000
MSDS revision	20th November 2002
MSDS Revised	10th December 2008
MSDS Revised	11th October 2011
MSDS Revised	12th May 2014

16.2 Abbreviations and acronyms

Not applicable

16.3 Key literature references and sources for data

ECHA European Chemicals agency

16.4 Classification for mixtures and used evaluation method according to regulation (EC) 1272/2008 [CLP]

Regulation (EU) No. 1272/2008.
Classification, labelling and packaging of substances and mixtures.
The product does not need to be labelled in accordance with Directive 67/548/EEC.
Not classified as a hazardous substance or mixture according to Directive 1999/45/EC.

16.5 Relevant R-, H- and EUH-phrases (number and full text)

Not applicable

16.6 Training advice

Follow training instructions when handling this material.

16.7 Further information

Not available.

Disclaimer

The information provided in the SDS is correct to the best of our knowledge at the date of publication. This document is intended as a guide for safe handling, storage and use in known industrial applications. The manufacturer makes no representation, warranty or guarantee as to its accuracy, reliability or completeness nor assumes any liability for its use. It is the users responsibility to confirm in advance that the information is current, applicable and suitable to their circumstances for each particular use. No representative of ours has authority to waive this provision.

SECTION 11

OIL & WINDING TEMPERATURE INDICATOR: QUALITROL AKM

(MANUFACTURER DETAILS - 6 PAGES)

APPENDIX E

OTIWTI™

Remote mount thermometers (AKM)

The next generation thermometer from the global leader

- Six switch capability, sequentially independent, with adjustable hysteresis
- Reduce failure costs with reliable AKM bellows operation
- Widest range of inputs and outputs including double gradient onboard
- Simple to work on with the new smart design case
- Further reduce your costs with the high switching capability no extra components for fan bank control and alarm trip

Product Summary

Description Capillary based, mechanical, remote indicating thermometer where electrical power is not required for indication. Configurations for oil temperature measurement and winding temperature simulation. Features up to 6 flexible switches for alarm, trip, and cooling system functions and can be equipped with various electronic outputs for SCADA and remote monitoring applications.

Application For oil (liquid) or simulated winding temperature indication with integrated features for control or alarm functions. Designed for use where the point of measurement (the well or pocket) is not easily viewed by personnel requiring separate or remote indication.

QUALITROL®
Defining Reliability

OTIWTI™ Remote mount thermometers (AKM)

The next generation thermometer from the global leader	• Over 75 years of experience designing mechanical temperature measurement devices for transformers • Over 250,000 capillary type thermometers in service worldwide in all environmental conditions • Improved connection ease with a greater number cable glands; 3xM25 style and 2xM20 style • Improved switching flexibility with up to 6 fully configurable switches • New and improved swing out case design allows for easy cable connection, switch configuration and testing without removal of the cover
Accomplish the most demanding control and alarm configurations	• Up to 6 fully independent switches flexible enough for most control and alarm schemes • Each switch can be specified by switch type, hysteresis range, and set point, without limitation of sequential set points • Standard switch rated for up to 15 Amps AC and up to 10 Amp DC, switches also available for higher VDC (magnetic blow out, M.B.O.), and switches for milliamp loads-- see technical specifications for more information • Various analog outputs also available (mA, Pt 100, and Cu 10) -- see technical specifications for more information • Each switch can be specified with adjustable hysteresis (5 to 25°C)
Reduce costs with reliable AKM bellows operation	• Non-pressured bellows system better resists leakage when compared to bourdon tube (pressurized) style capillary thermometers • Integrated heating element in bellows for winding temperature indication eliminates extra cost and complexity of accessories to simulate the winding • AKM bellows system provides a 260° dial deflection (angle the pointer travels from minimum to maximum) making it easier to interpret temperature reading from a distance
Minimize installation complexity with all-in-one design	• Single enclosure design minimizes need for additional accessories such as matching units and heated wells commonly used by other mechanical temperature solutions • New hinged cover enables easy access to switch settings and connections during installation while shielding device from elements. Features all captive screws and can be completely removed, if necessary • Same installation footprint and mounting options as the previous generation AKM 345 • Improved wiring installation with addition of 2 cable glands (for a total of 5) and an increase in size to 3xM25 and 2xM20 versus the previous generation
Simplify operations by using one family of thermometer for all environmental conditions	• Wide range of options allow for standard use of one thermometer series across a wide array of applications and operating conditions • Extreme temperature survivability with polar executions for use down to -60°C • Enclosures with IP55 or IP65 rating with numerous mounting configurations available • The most flexible switching capabilities available for implementation of any control and alarm configuration

New improved AKM OTIWTI™

AKM BELLOWS TECHNOLOGY
System provides a 260° dial deflection (angle the pointer travels from minimum to maximum) making it easier to interpret temperature reading from a distance

AKM BELLOWS TECHNOLOGY
Non-pressured bellows system better resists leakage when compared to bourdon tube (pressurized) style capillary thermometers

AKM BELLOWS TECHNOLOGY
Integrated heating element in AKM bellows for winding temperature indication eliminates extra cost and complexity of accessories to simulate the winding

ONE FAMILY OF THERMOMETER FOR ALL ENVIRONMENTAL CONDITIONS
Enclosures with IP55 or IP65 rating with numerous mounting configurations available including extreme temperatures down to -60°C

NEW CASE DESIGN
Swing out case design allows for easy terminal block connection, switch configuration and testing without removal of the cover

NEW 6 SWITCH CAPABILITY
Up to 6 fully independent switches flexible enough for most control and alarm schemes

IMPROVED WIRING INSTALLATION
Improved wiring installation with addition of 2 cable glands (for a total of 5) and an increase in size to 3xM25 and 2xM20 versus the previous generation

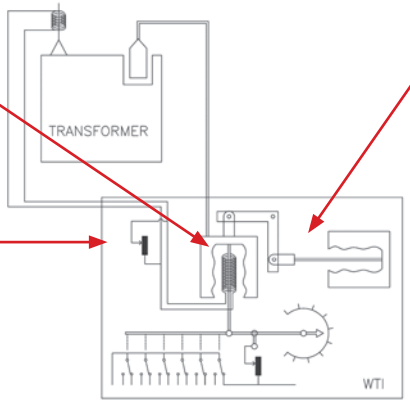
ELECTRONIC OUTPUTS (USER UPGRADE KITS AVAILABLE)
Various analog outputs available (mA, Pt 100, and Cu 10) -- user upgrade possible via rear access panel by trained personnel.

AKM345 DOUBLE GRADIENT OPTION
The Double Gradient option allows for setting two separate winding simulations in the same Winding Temperature Indicating Thermometer.

Winding system

Integrated heating element in AKM Measurement bellows simplifies winding temperature indication by eliminating the complexity of accessories to simulate the winding

Single enclosure design minimizes need for additional accessories such as matching units and heated wells commonly used by other mechanical temperature solutions



AKM Compensation bellow automatically compensates for ambient temperature

Options and accessories

Pockets/wells

- Pockets and wells available to fit all bulb types including IEC and ANSI standards

46950
46949
44595-1

Remote indicators

- Digital and analog indicators available for remote display of temperature measurement
- For use with 4-20 mA output option

47875 47877 47877-1

Power supply

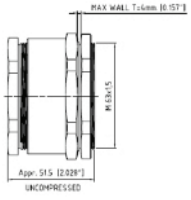
- For use with remote indicators and remote electronic outputs when 24 VDC is not available
- Universal Power Supply 85-264 VAC, 90-250 VDC
- Tolerance +10% or -15%
- DIN rail mounting

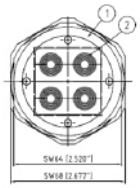
48510 48515

Pass through capillary gland

- For environmental isolation when capillary needs to pass through an enclosure

RG 63/4





Electronic output user upgrade kit

- Add electronic output capability to units previously purchased without output
- Upgrade possible through back access panel by trained personnel only

47675

Don't see what you need?
QUALITROL regularly creates models with special customer requirements.
Contact your local sales representative or QUALITROL Application Engineer to review your special requirements.

Email info@qualitrolcorp.com
www.qualitrolcorp.com

OTIWTI™ Remote mount thermometers (AKM)

TECHNICAL SPECIFICATIONS

Materials	Housing	Die-cast aluminum, polyester powder coat finish
	Capillary	Copper or copper/nickel with stainless steel jacket
	Lens	UV stabilized polycarbonate (standard), glass optional
Functional specification	Indication accuracy	±1.5% full-scale
	Standard measurement range	0 to 150°C (32°F to 302°F)
	Bulb types	Standard: 14mm diameter x 156mm length Available: for wells per DIN 42554, ASA C57.12.00
	Winding thermal image	Internal winding simulation: TD50 5 Amp/TD50 (up to 2.2A CT Max) or TD76 (up to 2.65A CT max) External winding simulation: (AKM 44678) up to 2A CT or (AKM 44674) up to 1.2A CT max, matching unit (AKM 44677) for up to 5A CT max
	Mounting styles	Stainless steel anti-vibration mount (standard), elastomeric seismic mount optional
	Cover	Swing up cover design, fully detachable, with all captive hardware
	Cable glands	3 x M25, 2 x M20
Output parameters	Number of switches	2 to 6 switches (independently specified types)
	Switch types	VAC, VDC, M.B.O. (magnetic blow out, high DC)
	Switching differential (hysteresis)	10° to 14°C for most dial ranges, optional adjustable differential from 5° to 25°C
	Switching accuracy	± 3% full-scale
	Optional remote outputs	Current loops: 0 to 1 or 4 to 20mA
		Voltage: 1-5V, etc...
		Resistive: Pt 100 or Cu 10 ohm
Environmental	Protection class	IP55 (standard), IP65 optional
	Dielectric isolation (hi pot)	2500 VAC at 50Hz, 60 seconds, all terminals to ground
	Surge withstand capability	IEEE C37.90.1 (TD111 output board only)
	Operating temperature	-40°C to 70°C (-40°F to 158°F), polar execution available -60°C to 50°C (-76°F to 122°F)
	Storage temperature	-50°C to 80°C (-58°F to 176°F)
	Humidity	95% non-condensing relative humidity @ 95°C (203°F)
	Vibration	50Hz/60Hz @ 0.1mm inch displacement, 3-axes
	Shock	10 G's half-sine, in three orthogonal planes

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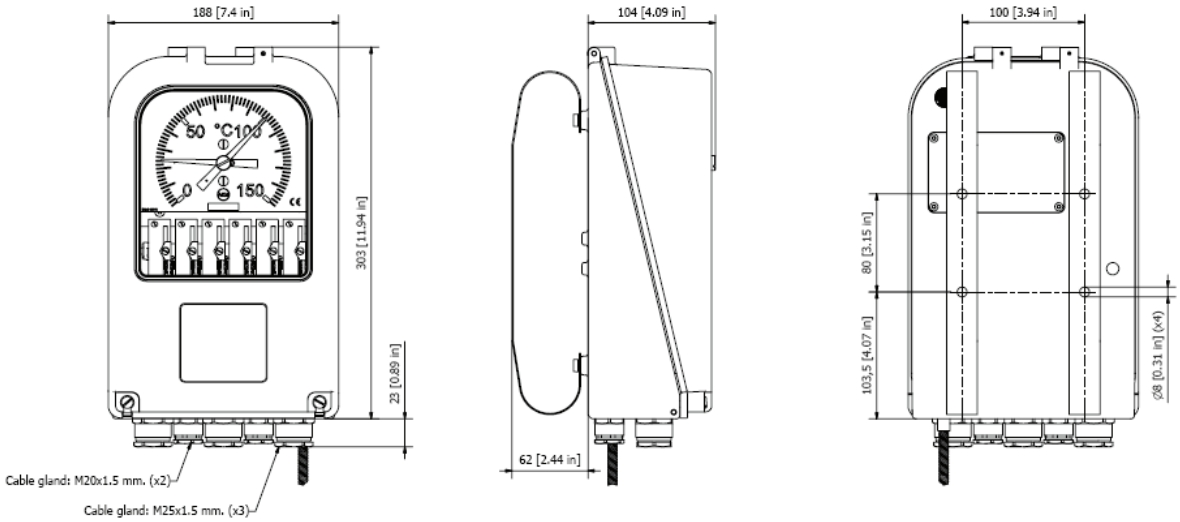
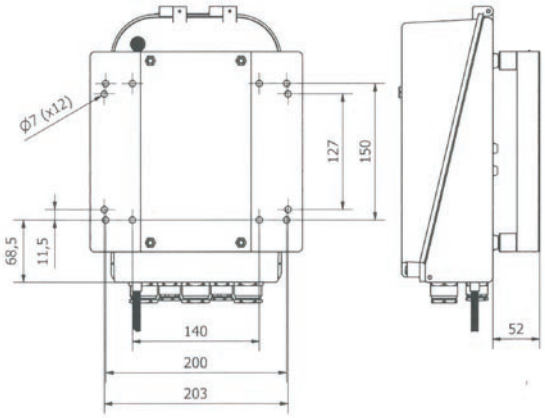
OTIWTI™ - Mounting styles and dimensions

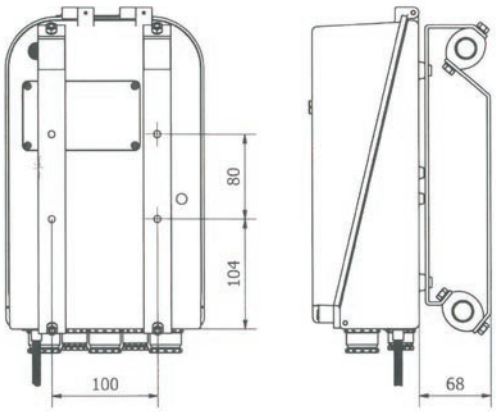
Standard mounting



Universal mounting



Siesmic mounting



QUALITROL® Field Services

To further improve reliability, QUALITROL provides comprehensive education and on-site commissioning services, maintenance contracts and technical support to all customers worldwide. Emergency response is available on all products and services.

About QUALITROL

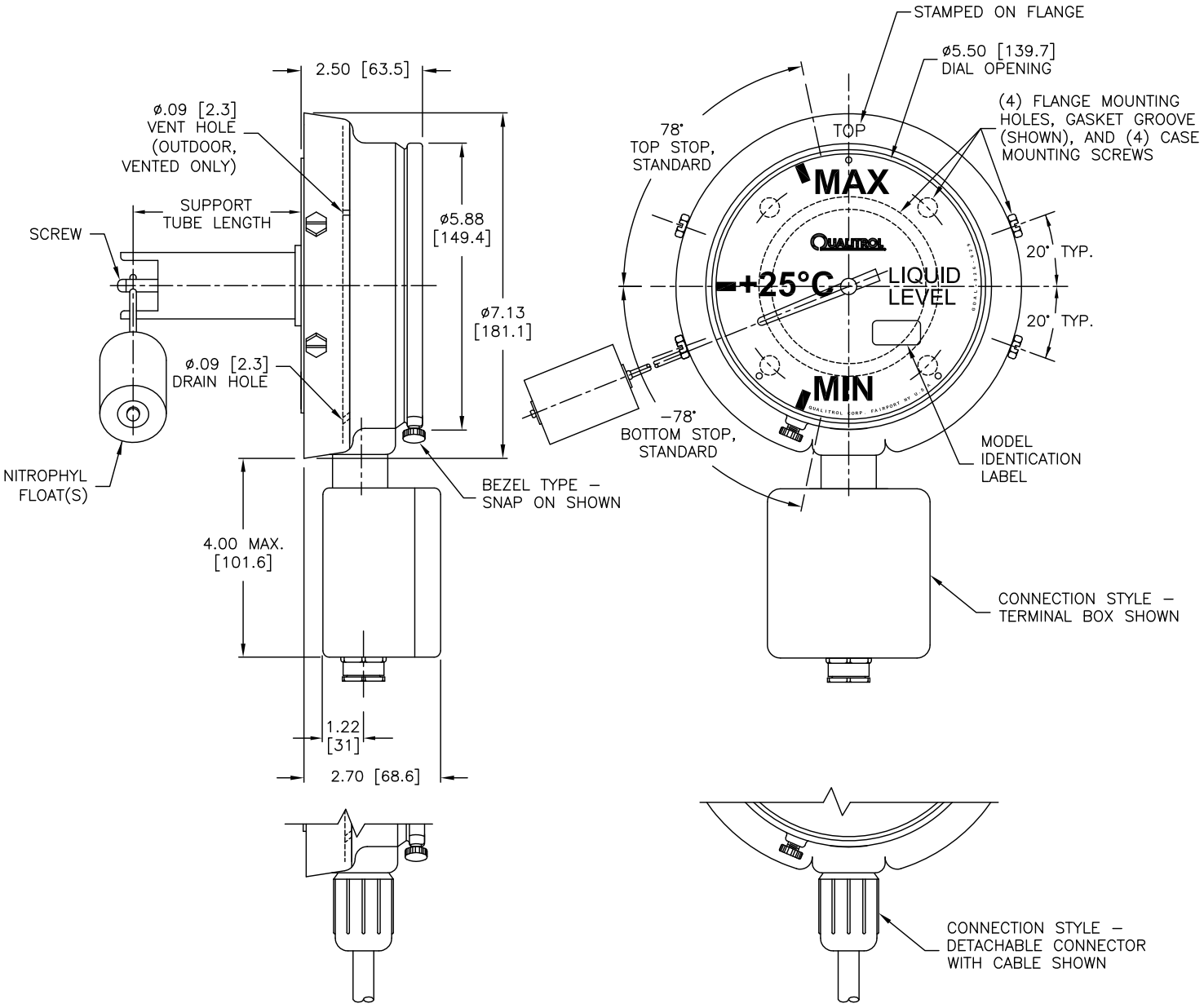
QUALITROL Company LLC manufactures substation and transformer monitoring and protection devices used by electric utilities and manufacturing companies. It is the global leader in sales and installations of transformer asset protection equipment, fault recorders and faul locators. Established in 1945, QUALITROL Company produces thousands of different types of products on demand, each customized to customers' unique requirements.

SECTION 12

APPENDIX F

OIL LEVEL GAUGE: QUALITROL LLG-032

(MANUFACTURER CATALOGUE - 4 PAGES)
(PRODUCT DATASHEET – 5 PAGES)



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE FOR REFERENCE AND SHOWN IN INCHES [MILLIMETERS].
2. SUPPORT TUBE LENGTH, BEZEL, CONNECTION, AND FLANGE MOUNTING OPTIONS ARE SPECIFIED ON ORDER.
3. STANDARD FINISH: ASA #70 LT GRAY.
4. CASE: ALUMINUM
5. BEZEL: STAINLESS STEEL
6. SUPPORT TUBE: BRASS
7. FLANGE: ALUMINUM
8. FLOAT ROD MUST BE ASSEMBLED TO EXTEND FROM COUNTERBORDED SIDE OF SHAFT.
9. INSULATION TEST: 2000 VOLTS TO GROUND FOR 60 SECONDS.
10. SWITCH RATING:
    10A @ 125, 250, 480 VAC
    1/2A @ 125 VDC – NON INDUCTIVE
    1/4A @ 250 VDC – NON INDUCTIVE

Product Information

6" Lever Drive Liquid Level Gauge
Option Sheet Part 1 of 2

Customer Name & Reference:

Reset | Print | Save As

Specify
- ☐ Case Assembly only
- ☐ Flange Assembly only
- ☐ Float Rod only
- ☐ LLG complete

Switch Rating
☐ STD	10 Amp @ 125/250 VAC w/ 2K Hi-Pot
☐ GOLD	0.10 Amp @ 125 VAC w/ 2K Hi-Pot

Switch Settings
Specify settings at either Dimension 'A', 'B', 'C', or 'D' (see note 3, refer to option sheet part 2)

Number of Switches	Switch #1	Switch #2
☐ None		
☐ 1		
☐ 2		

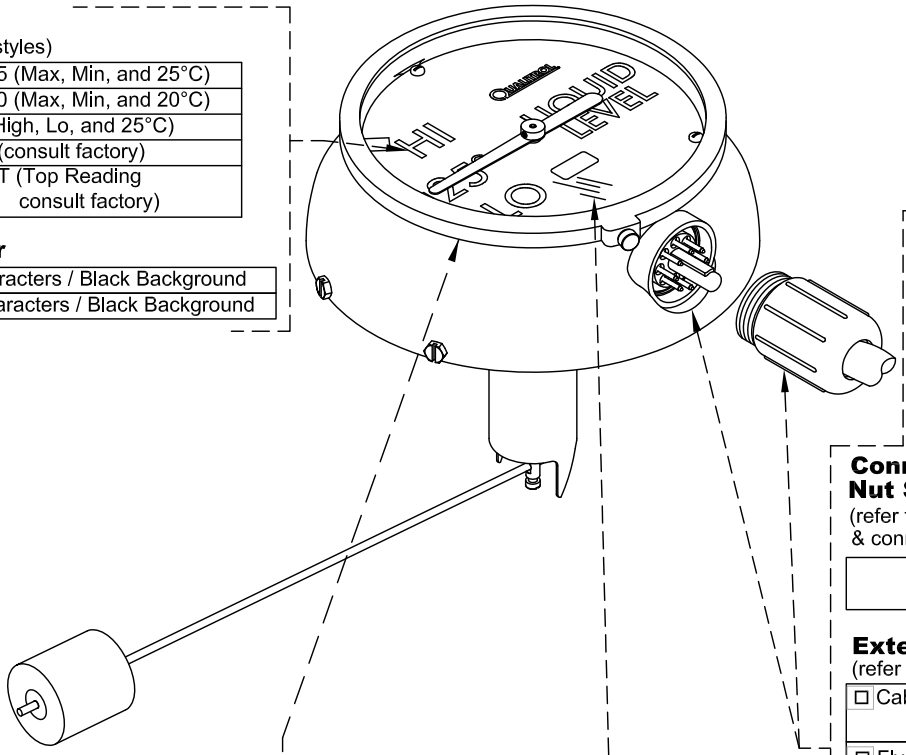
→ If switch #1 setting = switch #2 setting, then →

Switch Sequence
First switch operates min. 5 dial degree prior to grad
- ☐ Switch #1 before Switch #2 (min. 5 dial degrees separation)
- ☐ Switch #2 before Switch #1 (min. 5 dial degrees separation)
- ☐ None (max. 5 dial degrees separation)

Environment Conditions
- ☐ Outdoor, Vented (std.)
- ☐ Outdoor, Sealed
- ☐ Tropical, High Humidity

Dial Text
(refer to dial styles)
- ☐ MAXMIN25 (Max, Min, and 25°C)
- ☐ MAXMIN20 (Max, Min, and 20°C)
- ☐ HILO25 (High, Lo, and 25°C)
- ☐ CUSTOM (consult factory)
- ☐ CUSTOM/T (Top Reading consult factory)

Dial Color
- ☐ White Characters / Black Background
- ☐ Yellow Characters / Black Background



Connection Styles
(refer to device wiring & connector styles)
- ☐ Qualitrol (detachable)
- ☐ ANSI (detachable)
- ☐ Perm. Attached
- ☐ Terminal Box (requires Outdoor, Vented and 6 o'clock connector orientation)
- ☐ Military

Connector Nut Style
(refer to device wiring & connector styles)

Device Wiring
(refer to device wiring & connector styles)

External Wiring
(refer to device wiring & connector styles)

☐ Cable	☐ 16 Ga. SOW-A/SO (Std.) ☐ Other (consult factory)
☐ Flying Leads	☐ 16 Ga. TEW (Std.) ☐ 16 Ga. TEF ☐ 14 Ga. TEW
☐ None	
☐ Connector Parts Only	

Bezel Type
- ☐ Permanent (std.)
- ☐ Removable (requires Indoor/Outdoor)
- ☐ Snap-On w/ Test Feature (requires Indoor/Outdoor)

Lens Material
- ☐ Tempered Glass
- ☐ Polycarbonate

→ ☐ Polycarbonate

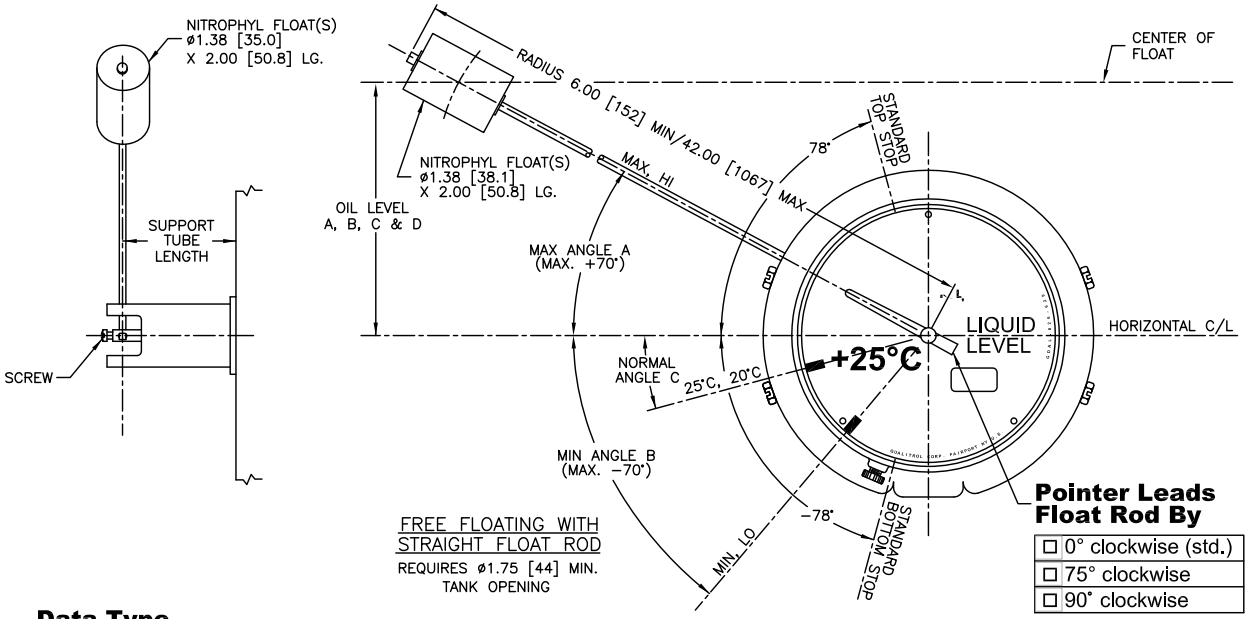
Length of Cable or Flying Leads

☐ Inches Specify 6" increments	☐ Meters Can be specified to 0.1 m
Length	

Connector Orientation
- ☐ At 3 o'clock (requires Outdoor, Sealed)
- ☐ At 6 o'clock (std.)

Note: Case mounting holes remain at 3 o'clock regardless of connector orientation.

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE FOR REFERENCE AND SHOWN IN INCHES [MILLIMETERS].
2. SWITCH REMAINS ACTUATED FOR APPROXIMATELY 90 DIAL DEGREES AFTER OPERATING.
3. SWITCHES OPERATE ON FALLING LEVEL FOR B, C, AND D AND ON RISING LEVEL FOR A.



Pointer Leads Float Rod By

- ☐ 0° clockwise (std.)
- ☐ 75° clockwise
- ☐ 90° clockwise

Data Type

- ☐ Angles — Given from Horizontal Center Line
- ☐ Oil Levels — Given from Horizontal Center Line (Same Units as Radius)

Radlus

☐ Inches	☐ Millimeters
Specify .05" increments	Specify 1 mm increments
Length =	

Note: If radius is specified in mm, then float rod screw will be metric

Data Input

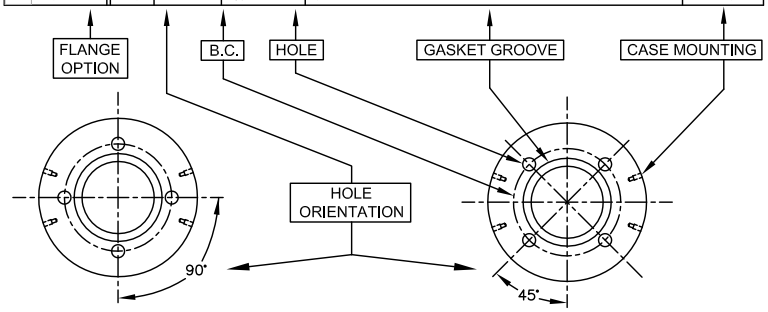
*use minus sign (-) for angles or oil levels below horizontal c/l and plus sign (+) for angles or oil levels above horizontal c/l

Max Angle/Level (required)	*A =
Min Angle/Level (required)	*B =
20°C/25°C Angle/Level (required except when ordering flange assembly only)	*C =
Optional Grad Angle/Level D must be between C & B (optional 4th graduation mark)	*D =

Notes: Total travel (A - B) must be minimum 80° and maximum 140°.
Maintain minimum angular separation of 10° between A, B, C and D.

Lever Drive Flange Mounting Styles (in inches unless otherwise noted)

☐ 45E31	45°	3.125	Ø.28	2.75 O.D. x 2.13 I.D. x .13 x .06 DP.	#10-32
☐ 45E32	45°	3.125	Ø.34	2.75 O.D. x 2.13 I.D. x .06 DP.	#10-32
☐ 45E33	45°	3.125	Ø.34	2.75 O.D. x 2.13 I.D. x .13 x .06 DP.	#10-32
☐ 45E34	45°	3.125	Ø.34	2.63 O.D. x 1.75 I.D. x .08 DP.	#10-32
☐ 45E41	45°	4.000	Ø.44	3.38 O.D. x 2.63 I.D. x .06 DP.	#10-32
☐ 45E42	45°	4.000	Ø.44	N/A	#10-32
☐ 45E43	45°	4.000	Ø.44	3.38 O.D. x 2.63 I.D. x .13 x .09 DP.	#10-32
☐ 45E44	45°	4.000	Ø.44	3.38 O.D. x 2.63 I.D. x .09 DP.	#10-32
☐ 45E45	45°	4.750	Ø.56	4.00 O.D. x 3.12 I.D. x .12 DP.	#10-32
☐ 45E51	45°	5.000	Ø.34	3.81 O.D. x 3.31 I.D. x .13 DP.	#10-32
☐ 90E31	90°	3.125	Ø.34	2.75 O.D. x 2.13 I.D. x .06 DP.	#10-32
☐ 90E32	90°	3.125	Ø.28	2.75 O.D. x 2.13 I.D. x .06 DP.	#10-32
☐ 90E33	90°	3.125	Ø.28	N/A	#10-32
☐ 90E34	90°	3.125	Ø.34	2.75 O.D. x 2.13 I.D. x .13 x .06 DP.	#10-32
☐ 90E35	90°	3.125	Ø.34	2.63 O.D. x 1.75 I.D. x .08 DP.	#10-32
☐ 45M41	45°	4.000	Ø13MM	N/A	M5
☐ 45M42	45°	4.000	Ø7MM	87MM O.D. x 72.4MM I.D. x 4.3MM DP.	M5



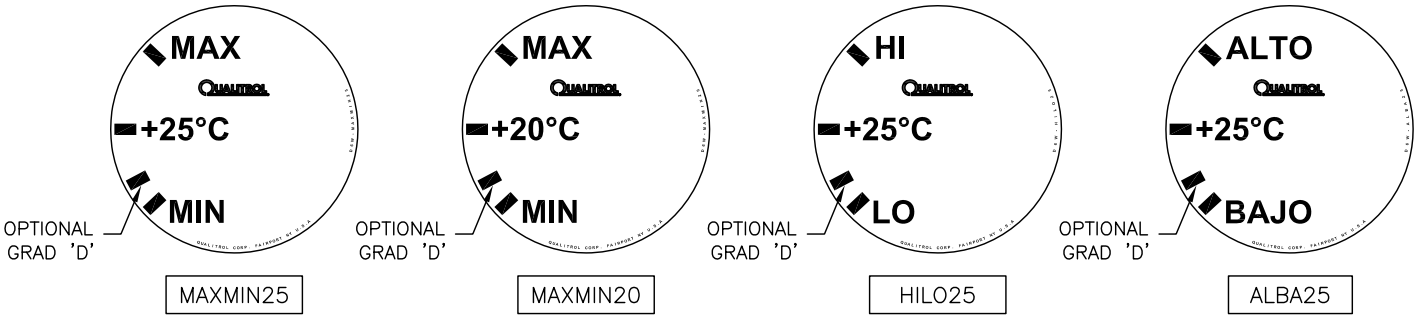
Support Tube Length (inches/mm)

- ☐ 2.17 / 55MM
- ☐ 3.00 / 76MM
- ☐ 3.15 / 80MM
- ☐ 3.94 / 100MM
- ☐ 5.91 / 150MM
- ☐ 7.87 / 200MM

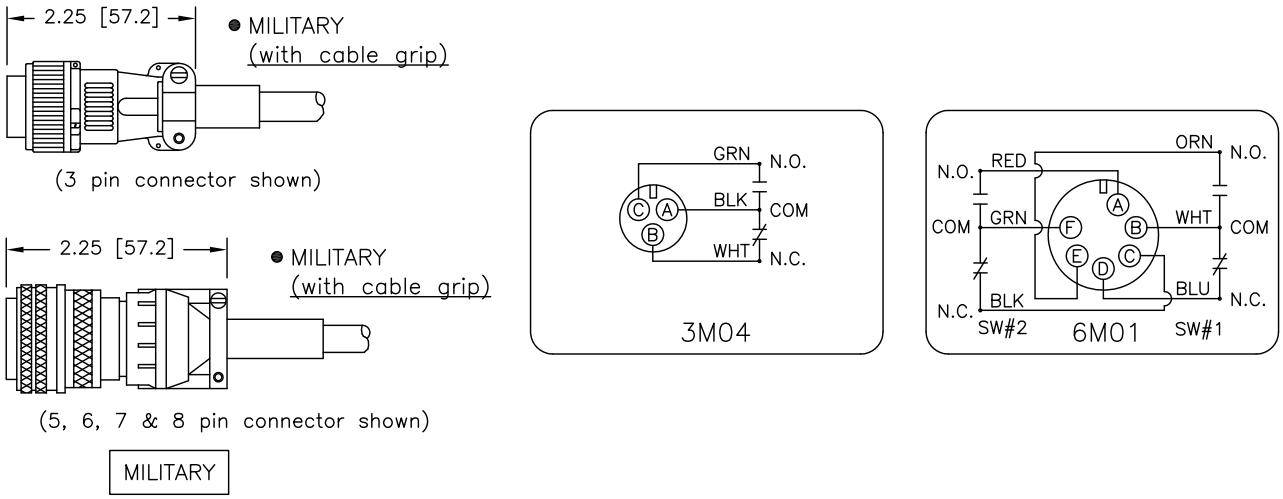
Note: For custom top reading dials, select 3.00/76MM support tube only

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE FOR REFERENCE AND SHOWN IN INCHES [MILLIMETERS].
2. ALL ANGULAR DEGREE REFLECT FLOAT ROD TRAVEL.

DIAL STYLES

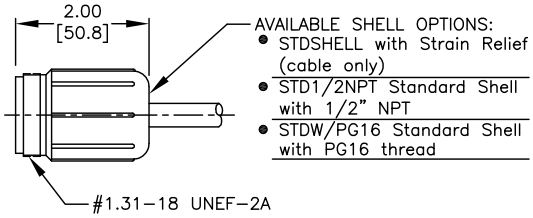


CONNECTOR NUT STYLES AND DEVICE WIRING
FOR MILITARY DETACHABLE CONNECTORS



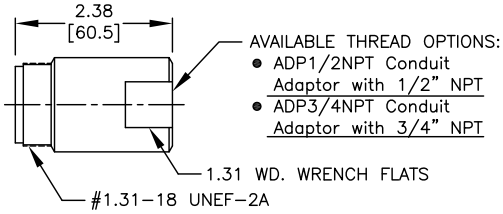
CONNECTOR NUT STYLES AND DEVICE WIRING FOR QUALITROL AND ANSI DETACHABLE CONNECTORS

STANDARD NUT



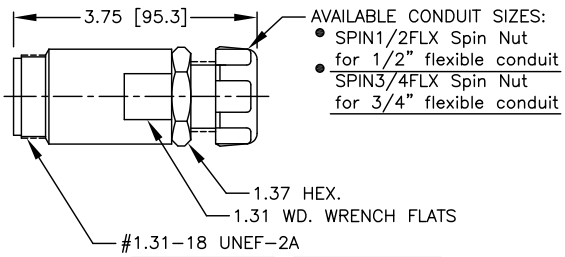
STDSHELL | STD1/2NPT | STDW/PG16

CONDUIT ADAPTOR



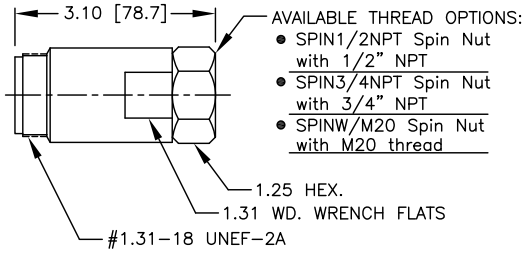
ADP1/2NPT | ADP3/4NPT

SPIN NUT (FLEX CONDUIT ADAPTOR)

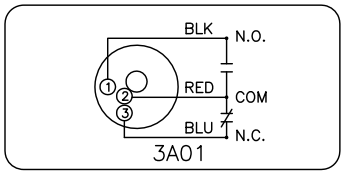


SPIN1/2FLX | SPIN3/4FLX

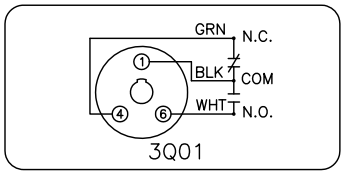
SPIN NUT (CONDUIT ADAPTOR)



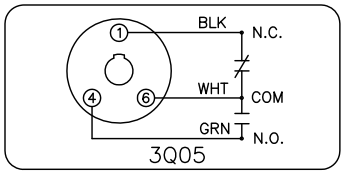
SPIN1/2NPT | SPIN3/4NPT | SPINW/M20



3A01



3Q01



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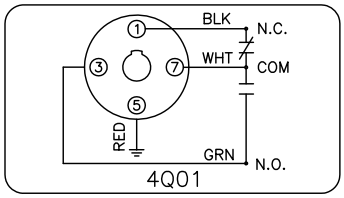
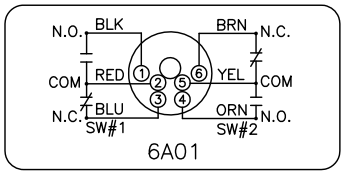
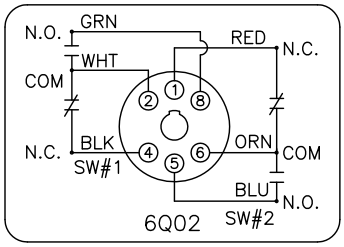


4Q01



6A01



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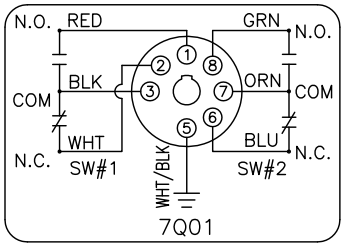
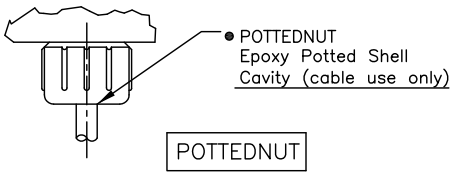


7Q01

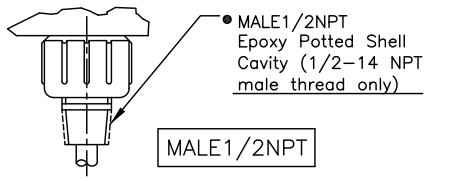
CONNECTOR NUT STYLES AND DEVICE WIRING FOR PERMANENTLY ATTACHED CABLES AND WIRES

POTTED CABLE CONNECTION



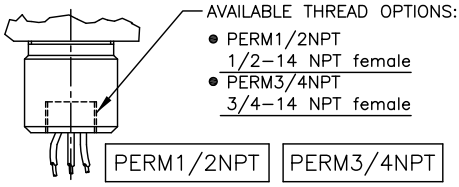
POTTEDNUT

MALE CONDUIT CONNECTION

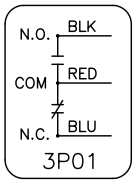


MALE1/2NPT

FEMALE CONDUIT CONNECTION



PERM1/2NPT | PERM3/4NPT



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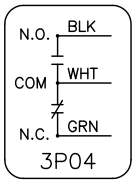

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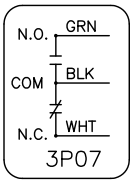

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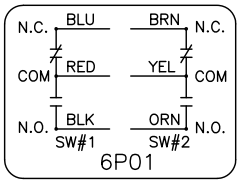

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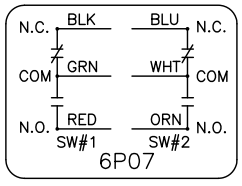
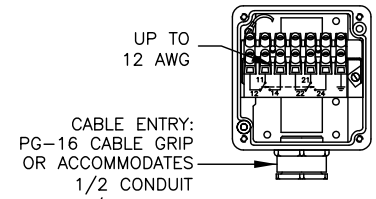
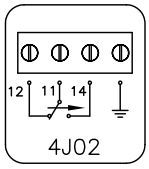


6P07

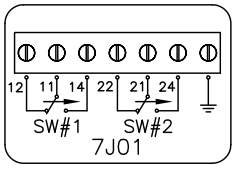
DEVICE WIRING FOR TERMINAL BOX

TERMINAL BOX: 1 & 2 SWITCH W/ GROUND (2 SWITCH VERSION SHOWN)





4J02



7J01

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE FOR REFERENCE AND SHOWN IN INCHES [MILLIMETERS].

ALL WIRING SHOWN AS VIEWED FROM OUTSIDE OF ENCLOSURE. ALL SWITCH FUNCTIONS SHOWN IN NON–ALARM STATE.
STD. CABLE IS 16 GA. TYPE SOW–A/SO. STD. FLYING LEADS ARE 16 GA. TYPE TEW.

QUALITROL® 032/045 & AKM 44712

Large oil level indicators

Better transformer protection with accurate oil level monitoring and alarm and limit functions

- Rugged design and corrosion resistant materials provide long, trouble free life
- Many options provide customized solutions for your application

Product Summary

Description Provides continuous indication of the liquid level inside of a transformer's main tank, conservator tank or load tap changer compartment. Models available with gear driven or lever driven float mechanisms. Gear driven mechanism provides amplified pointer movement relative to corresponding float travel. Lever driven gauges offers slimmer profile for tight spaces within a transformer. Integrated switches allow for limit and alarm control functions.

Application For monitoring of the liquid level inside a transformer's conservator and/or main tank, load tap changer compartment, or other vessels where liquid level is critical.

QUALITROL®
Defining Reliability

Better transformer protection with accurate oil level monitoring and alarm and limit functions

- Low level and high level alarm control is made possible with up to 3 integrated switches for 032, 042 and 045 models and up to 4 switches for 44712 and 34725 models
- Gear driven mechanism provides amplified pointer movement relative to the corresponding float movement for enhanced clarity of visual display
- Models with analog output (0-1 mA or 4-20 mA) allow for continuous remote monitoring of oil level

Rugged design and corrosion resistant materials provide long, trouble free life

- Die-cast aluminum housing is coated with a thermosetting powder coat finish
- Stainless steel and corrosion resistant parts protect gauge against harsh environmental conditions
- Optional UV resistant polycarbonate lens resists yellowing with age
- 045 models are designed for hazerdous locations and are UL listed for class 1 div 2

Many options provide customized solutions for your application

- Switching can be supplied for various liquid levels
- Both industry-standard and custom engineered dial markings are available
- A wide variety of electrical connections are available including quick connects, Military style, ANSI, conduit-ready and terminal box styles

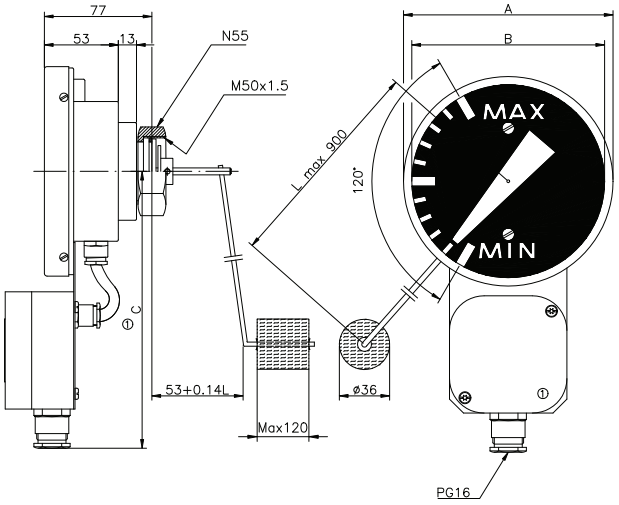
032/042/045 TECHNICAL SPECIFICATIONS

Mechanical	Mounting	Flange mount, various sizes available
	Float mechanism	Gear (042 and 045 series) or lever (032 series)
Dimensions	Dial diameter	5.5” (140mm)
Materials	Case	Die cast aluminum
	Bezel	Stainless steel
	Flange	Aluminum (standard), brass
	Float rod	Brass, copper coated steel or aluminium
	Float	Nitrophyl, steel, cork, homogenous acrylate plastic
	Lens	UV stabilized polycarbonate (standard), glass or tempered glass
Electrical	Connection type	Terminal box or permamently attached (standard), quick connectors, sealed-weatherproof connectors
	Number of switches	Up to 3
	Switch rating (AC)	10A @ 125, 250, 480 VAC
	Switch rating (DC)	1/2A @ 125 VDC, resistive
		1/4A @ 250 VDC, resistive
	Switch type	SPDT
	Dielectric strength	1,500 VAC for 60 seconds
Scada output	Output signal	4 - 20 mA (optional 0-1 mA on 039 series)
	Supply voltage	24 VDC nominal (120 or 240 VAC on 039 series)
	Max load	600Ω

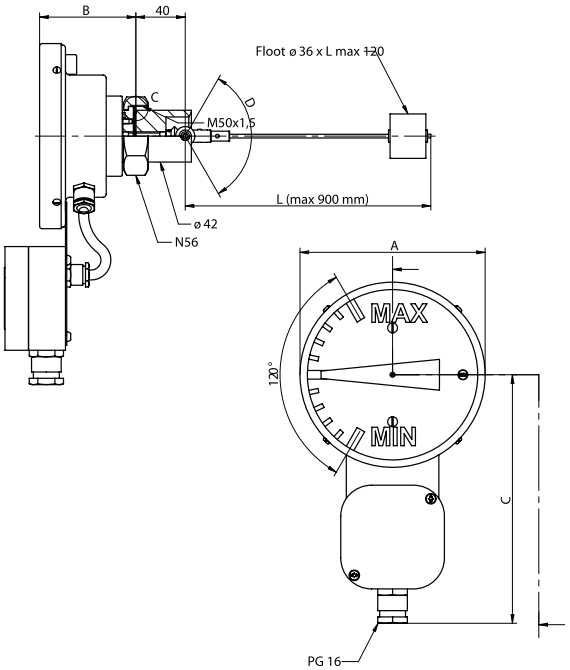
44712/34725 TECHNICAL SPECIFICATIONS

Mechanical	Mounting	M50 thread mount
	Float mechanism	Gear (34725) or lever (44712)
Dimensions	Dial diameter	5.9” (150 mm) or 9.8” (250 mm)
Materials	Case	Die cast aluminum, stainless steel
	Bezel	Stainless steel
	Flange	Aluminum (standard), brass
	Float rod	Brass, copper coated steel or aluminium
	Float	Nitrophyl, steel, cork, homogenous acrylate plastic
	Lens	UV stabilized polycarbonate (standard), glass or tempered glass
Electrical	Connection type	Terminal box (standard) or permamently attached, quick connects, sealed-weatherproof connectors
	Number of switches	4
	Switch rating (AC)	5A @ 250 VAC
	Switch rating (DC)	0.30A @ 125 VDC, resistive
	Switch type	SPST or SPDT
	Dielectric strength	2,000 VAC for 60 seconds
Scada output	Output signal	4 - 20 mA
	Supply voltage	24 VDC nominal
	Max load	600Ω

44712 Series



34725 Series



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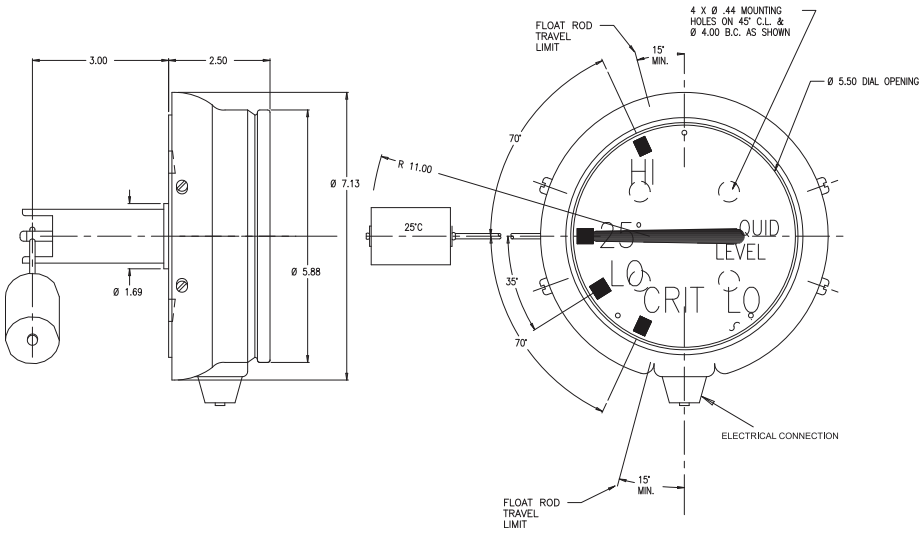
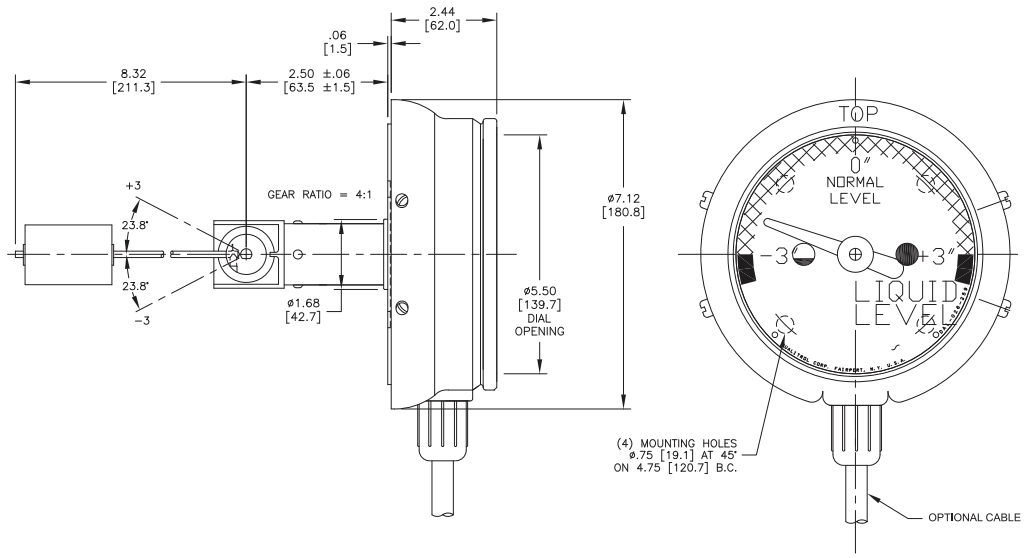
www.qualitrolcorp.com

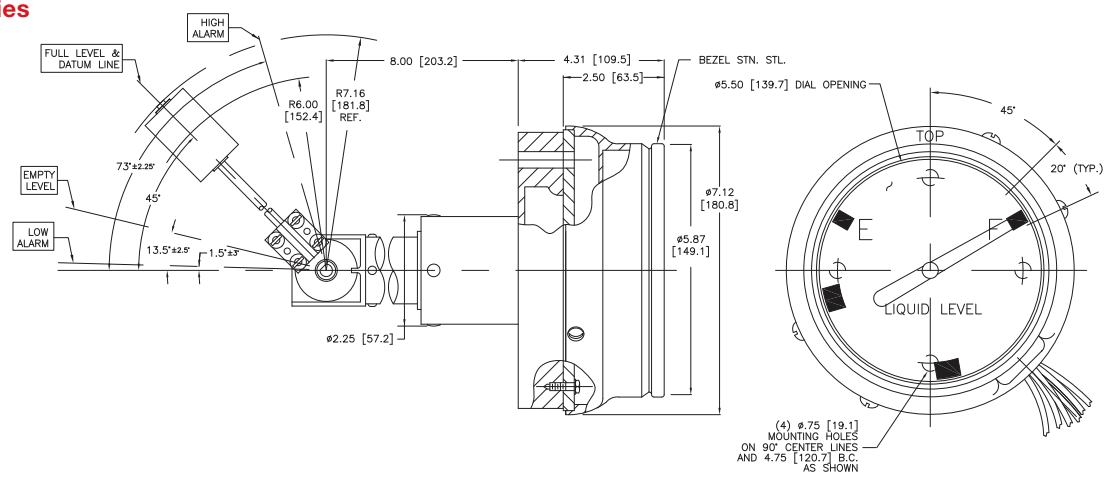
032 Series



042 Series



045 Series



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SECTION 13

APPENDIX G

PAINT SPECIFICATION: No. 704-60170

(PAINT PROCEDURE - 15 PAGES)

IST POWER LTD

PAINT APPLICATION AND PREPARATION PROCEDURE FOR

LIQUID FILLED TRANSFORMERS FOR C3 (H) PROTECTION (>15 years)

AND C4 (M) PROTECTION (5 – 15 YEARS)

Quality Process Instruction

Quick Guide

a) All sharp edges and corners must be removed; welds dressed smooth, all welding spatter should be removed.
b) All areas are to be thoroughly cleaned of any contamination before metal spraying or painting.
c) The manufacturers paint datasheets form part of this specification and must be adhered to.
d) Paint records must be taken

Circulation/storage
REFER TO "ISSUED DOCUMENT REGISTER" HELD BY COMPLIANCE

Ref: 704-60170 Issue: 3	Author: Peter Jones Approved for Issue: Peter Jones Date: 18/9/18	Change Ref: G287

Safety

1. Review and adhere to all instructions contained in the company HSE Policies ref.GHI-001 & 002 (see company notice boards).
2. Review and adhere to all paint safety data sheet instructions referenced in this instruction (copies in COSHH folders)
3. PPE required: Full face respiratory mask, gloves, coveralls and safety footwear. Ensure no loose items of clothing or accessories.
4. Maintain a clean & tidy work area – remove potential trip hazards
5. Near Miss and HSE concerns must be reported by the "ARF" system, or directly to the Health & Safety Representative/Manager

Scope

This specification covers the cleaning, preparation & preservation of ONAN & KNAN steel tanks for outdoor use in extreme weather conditions, and salt laden & heavily polluted environments.

Summary of corrosion protection system

The corrosion protection of the steel components of the transformers will be as follows:

Interior

- Blast clean
- 2 pack Epoxy paint

Exterior

- Blast clean
- 2 pack Epoxy zinc phosphate/micaceous iron oxide primer
- 2 pack Acrylic Polysiloxane finish

The manufacturers paint datasheets form part of this specification.

During the painting process the manufacturer guidelines for mixing, spraying, curing/drying & over coating are to be followed.

Pre-blast clean inspection

All sharp edges and corners must be removed; welds dressed smooth, all welding spatter should be removed.

All welds are to be dressed smooth in accordance with the 'good' standard of ISO 12944-3. All welds must be inspected for undercuts/irregularities and made good where necessary.

Exterior

Blast clean

The exterior of the transformer tanks and conservators to be grit blasted to SA 2 1/2 of ISO 8501-1. Particular attention is to be made in hard to reach areas.

Mask stainless steel earth pads before blasting.

All areas are to be thoroughly cleaned of any contamination before metal spraying.

Exterior Painting

A stripe coat is required on all edges, welds and hard to reach areas for all layers of paint.

Primer/Sealer

Paint Manufacturer: International
Paint Type: Two component epoxy primer
Paint Description: Intercure 200
No of coats: One
Coat thickness: 80 µm (minimum DFT)
Colour: Light Grey
Drying Time:

Temperature	Touch Dry	Hard Dry	Minimum
5˚C	40 min	4.5 hours	3 hours
15˚C	30 min	3 hours	2 hours
25˚C	20 min	2 hours	1 hours
40˚C	15 min	30 min	30 min

Finish coat

Paint Manufacturer: International
Paint Type: Two component acrylic polysiloxane
Paint Description: Interfine 979
No of coats: One
Coat thickness: 100 µm (minimum DFT)
Colour: Refer to tank fabrication drawing for Final Colour
Drying Time:

Temperature	Touch Dry	Hard Dry	Minimum
5˚C	6 hours	8 hours	8 hours
15˚C	4.5 hours	6 hours	6 hours
25˚C	3 hours	4 hours	4 hours
40˚C	1.5 hours	2.5 hours	2.5 hours

Note: Minimum external dry film thickness is 180 microns

Interior

Blast Clean

The interior of the transformer tanks and conservators it to be grit blasted to SA 2 ½ of ISO 8501-1. All surplus grit and residue must be removed before painting.

Painting is to be carried out within four hours of grit blasting.

Interior Painting

All of the transformer interior should be painted with Valspar 39,0009-50.

Interior paint

Paint Manufacturer: Valspar
Paint Type: Two component epoxy primer
Paint Description: Valspar
No of coats: One
Coat thickness: 40 µm (minimum DFT)
Colour: White

Temperature	Touch Dry	Hard Dry	Minimum
20˚C		6 hours	6 hours

Paint Repair Procedure

If the paint coating is damaged in any way, repairs must be done to the following procedure.

Using hand or mechanical means, rub down the affected area so that all paint coats are feathered towards the damaged area.

Clean down and thoroughly degrease.

Each coat of paint is to overlap the previous coat. Minimum film thicknesses are to be maintained.

All coats of paint are to be applied by brush.

Primer/Sealer

Paint Manufacturer: International
Paint Type: Two component epoxy primer
Paint Description: Intercure 200
No of coats: One
Coat thickness: 80 µm (minimum DFT)
Colour: Light Grey
Drying Time:

Temperature	Touch Dry	Hard Dry	Minimum
5°C	40 min	4.5 hours	3 hours
15°C	30 min	3 hours	2 hours
25°C	20 min	2 hours	1 hour
40°C	15 min	30 min	30 min

Finish coat

Paint Manufacturer: International
Paint Type: Two component acrylic polysiloxane
Paint Description: Interfine 979
No of coats: One
Coat thickness: 100 µm (minimum DFT)
Colour: Refer to tank fabrication drawing for Final Colour
Drying Time:

Temperature	Touch Dry	Hard Dry	Minimum
5°C	6 hours	8 hours	8 hours
15°C	4.5 hours	6 hours	6 hours
25°C	3 hours	4 hours	4 hours
40°C	1.5 hours	2.5 hours	2.5 hours

Note: Minimum external dry film thickness is 180 microns

Intercure® 200

Rapid Recoat Epoxy

PRODUCT DESCRIPTION

A two component epoxy zinc phosphate/micaceous iron oxide primer, formulated on proprietary polymer technology, which provides rapid cure and overcoating even under low temperature conditions.

A high solids, low VOC product.

INTENDED USES

As a primer for steelwork intended for use in a wide range of aggressive environments, including offshore, chemical and petrochemical plants, industrial buildings, pulp and paper mills, power plants and bridges.

Suitable for overcoating within 3 hours in most climatic conditions hence speeding up production and throughput in fabrication shops.

Can also be used on site as a rapid curing, maintenance coating.

PRACTICAL INFORMATION FOR INTERCURE 200

Colour	Buff, Red Oxide
Gloss Level	Matt
Volume Solids	67%
Typical Thickness	75-100 microns (3-4 mils) dry equivalent to 112-149 microns (4.5-6 mils) wet
Theoretical Coverage	8.90 m²/litre at 75 microns d.f.t and stated volume solids 358 sq.ft/US gallon at 3 mils d.f.t and stated volume solids
Practical Coverage	Allow appropriate loss factors
Method of Application	Airless Spray, Air Spray, Brush, Roller

Drying Time

			Overcoating Interval with recommended topcoats	
Temperature	**Touch Dry**	**Hard Dry**	*Minimum*	*Maximum*
5°C (41°F)	40 minutes	4.5 hours	3 hours	Extended[1]
15°C (59°F)	30 minutes	3 hours	2 hours	Extended[1]
25°C (77°F)	20 minutes	2 hours	1 hour	Extended[1]
40°C (104°F)	15 minutes	30 minutes	30 minutes	Extended[1]

[1] See International Protective Coatings Definitions and Abbreviations

Maximum overcoating intervals are shorter when using polysiloxane topcoats. Consult International Protective Coatings for further details.

REGULATORY DATA

Flash Point	Part A 27°C (81°F); Part B 28°C (82°F); Mixed 27°C (81°F)	
Product Weight	1.60 kg/l (13.4 lb/gal)	
VOC	2.67 lb/gal (320 g/lt) 213 g/kg	EPA Method 24 EU Solvent Emissions Directive (Council Directive 1999/13/EC)

See Product Characteristics section for further details

ECOTECH

Ecotech is an initiative by International Protective Coatings a world leader in coating technology to promote the use of environmentally sensitive products across the globe.

SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:2000.

Oil or grease should be removed in accordance with SSPC-SP1 solvent cleaning.

Abrasive Grit Blast Cleaning

Abrasive grit blast clean to Sa2½ (ISO 8501-1:2007) or SSPC-SP6. If oxidation has occurred between blasting and application of Intercure 200, the surface should be reblasted to the specified visual standard.

Surface defects revealed by the blast cleaning process should be ground, filled, or treated in the appropriate manner.

A sharp, angular surface profile of 50-75 microns (2-3 mils) is recommended.

Intercure 200 is suitable for application to grit blast cleaned surfaces which were initially to the above standard but have been allowed to deteriorate under good shop conditions for up to 7-10 days. The surface may deteriorate to Sa2 standard but must be free from loose powdery deposits.

Shop Primed Steel

Weld seams and damaged areas should be grit blast cleaned to Sa2½ (ISO 8501-1:2007) or SSPC-SP6.

If the shop primer shows extensive or widely scattered breakdown overall grit sweep blasting may be necessary.

If the shop primer was applied over shot blasted surfaces, overall grit sweep blasting will be necessary prior to application of Intercure 200.

APPLICATION

Mixing

Material is supplied in two containers as a unit. Always mix a complete unit in the proportions supplied. Once the unit has been mixed it must be used within the working pot life specified.

(1) Agitate Base (Part A) with a power agitator.
(2) Combine entire contents of Curing Agent (Part B) with Base (Part A) and mix thoroughly with power agitator.

Mix Ratio

3 part(s) : 1 part(s) by volume

Working Pot Life

5°C (41°F)	15°C (59°F)	25°C (77°F)	40°C (104°F)
6 hours	3 hours	2 hours	45 minutes

Airless Spray	Recommended	Tip Range 0.43-0.53 mm (17-21 thou) Total output fluid pressure at spray tip not less than 176 kg/cm² (2503 p.s.i.)
Air Spray (Pressure Pot)	Recommended	Gun DeVilbiss MBC or JGA Air Cap 704 or 765 Fluid Tip E
Brush	Suitable - small areas only	Typically 50-75 microns (2.0-3.0 mils) can be achieved
Roller	Suitable - small areas only	Typically 50-75 microns (2.0-3.0 mils) can be achieved
Thinner	International GTA220 (or International GTA415)	Do not thin more than allowed by local environmental legislation
Cleaner	International GTA220	(or International GTA415)

Work Stoppages

Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with International GTA220. Once units of paint have been mixed they should not be resealed and it is advised that after prolonged stoppages work recommences with freshly mixed units.

Clean Up

Clean all equipment immediately after use with International GTA220. It is good working practice to periodically flush out spray equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays.

All surplus materials and empty containers should be disposed of in accordance with appropriate regional regulations/legislation.

PRODUCT CHARACTERISTICS

Intercure 200 is preferred for use with systems for chemical environments where zinc based materials can be subject to attack in both acidic and alkaline conditions.

The maximum overcoating interval will be dependent upon the integrity of the exposed film. A film of 75 microns (3 mils) dry film thickness will normally be overcoatable after 6 months exposure provided it is adequately cleaned and any areas of mechanical damage repaired.

Over-application should be avoided as thick films will not be as good a substrate for topcoat adhesion after ageing as those at the specified thickness. When using as a blast holding primer avoid over-application as thick films may suffer from cohesive film splitting if subsequent coats are also over-applied.

Surface temperature must always be a minimum of 3°C (5°F) above dew point.

This product must only be thinned using recommended International thinners. The use of alternative thinners, particularly those containing ketones, can severely inhibit the curing mechanism of the coating.

Intercure 200 is capable of curing at temperatures below 0°C (32°F). However, this product should not be applied at temperatures below 0°C (32°F) where there is a possibility of ice formation on the substrate.

For further details regarding cure times and overcoatability, please contact International Protective Coatings.

This product is not available in pale and pastel shades due to a tendency to discolour rapidly. Additionally, in common with all epoxies Intercure 200 will chalk on exterior exposure. However, these phenomena are not detrimental to anti-corrosive performance.

In C1 and C2 corrosive environments (ISO 12944) it is possible to repair weld seams and small damaged areas via hand or power tool cleaning. Consult International Protective Coatings for more information.

Intercure 200 is not intended for use as a primer for steelwork which may be subjected to immersion conditions.

Intercure 200 can also be used as a primer for substrates other than blasted steel, e.g. stainless steel, alloys, etc. Consult International Protective Coatings for further details.

Absolute measured adhesion of topcoats to aged Intercure 200 is less than that to fresh material, however, it is adequate for the specified end use.

Note: VOC values quoted are based on maximum possible for the product taking into account variations due to colour differences and normal manufacturing tolerances.

Low molecular weight reactive additives, which will form part of the film during normal ambient cure conditions, will also affect VOC values determined using EPA Method 24.

SYSTEMS COMPATIBILITY

Intercure 200 will normally be applied to suitably prepared steel, e.g. blast cleaned. However, if necessary, application over prefabrication blast primers can be performed. Consult International Protective Coatings for further details.

The following primers are recommended for Intercure 200:

Interzinc 22 (mist coat or tie coat may be required)*

The following topcoats/intermediates are recommended for Intercure 200:

Intercure 420	Interseal 670HS
Interfine 979	Interthane 990
Intergard 475HS	Interzone 1000
Intergard 740	Interzone 954

For other suitable topcoats/intermediates, consult International Protective Coatings.

*See relevant product data sheet for details.

ADDITIONAL INFORMATION

Further information regarding industry standards, terms and abbreviations used in this data sheet can be found in the following documents available at www.international-pc.com:

- Definitions & Abbreviations
- Surface Preparation
- Paint Application
- Theoretical & Practical Coverage

Individual copies of these information sections are available upon request.

SAFETY PRECAUTIONS

This product is intended for use only by professional applicators in industrial situations in accordance with the advice given on this sheet, the Material Safety Data Sheet and the container(s), and should not be used without reference to the Material Safety Data Sheet (MSDS) which International Protective Coatings has provided to its customers.

All work involving the application and use of this product should be performed in compliance with all relevant national, Health, Safety & Environmental standards and regulations.

In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation.

If in doubt regarding the suitability of use of this product, consult International Protective Coatings for further advice.

PACK SIZE	Unit Size	Part A		Part B	
		Vol	Pack	Vol	Pack
	20 litre	15 litre	20 litre	5 litre	5 litre
	4 US gal	3 US gal	5 US gal	1 US gal	1 US gal
	For availability of other pack sizes, contact International Protective Coatings.				

SHIPPING WEIGHT	Unit Size	Part A	Part B
	20 litre	29.1 kg	5.3 kg
	4 US gal	49.8 lb	8.8 lb

STORAGE		
	Shelf Life	12 months minimum at 25°C (77°F). Subject to re-inspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.

Important Note

Issue date: 07/07/2009

www.international-pc.com

Interfine® 979

Acrylic Polysiloxane

PRODUCT DESCRIPTION

A patented (US 6,281,321 and EP 0 941290), high performance, two component, high solids inorganic hybrid finish which offers compliance to all current VOC legislation, and contains no free isocyanates.

Interfine 979 significantly improves upon the gloss and colour retention exhibited by typical polyurethane finishes as well as offering improvement in gloss and colour retention when compared to 1st generation epoxy modified polysiloxane finishes.

Interfine 979 also displays the same corrosion resistance and has enhanced mechanical properties when compared to traditional epoxy technology.

INTENDED USES

Interfine 979 is part of International's premium range of polysiloxane finishes. It is designed to provide excellent long-term colour and gloss retention and provide extended lifetime to first maintenance when utilised as part of a high performance anti-corrosive system. Interfine 979 is intended for use in those market sectors where visual impact is important, and the need for a high standard of cosmetic appearance is required. These include high performance constructions such as bridges, offshore structures and tank farms in addition to general industrial and commercial steelwork where high levels of cosmetic performance are a key requirement.

The dual benefits of corrosion protection & high cosmetic appearance afforded by Interfine 979 mean that as well as exhibiting superior durability, this product also serves as an effective barrier coat similar to a traditional epoxy intermediate, and as such, allows a reduction in the total number of coats required from a multi-coat high performance system - saving application costs, and improving productivity during application.

PRACTICAL INFORMATION FOR INTERFINE 979

Colour	Wide range via the Chromascan system
Gloss Level	Gloss
Volume Solids	76%
Typical Thickness	100-150 microns (4-6 mils) dry equivalent to 132-197 microns (5.3-7.9 mils) wet
Theoretical Coverage	6.10 m²/litre at 125 microns d.f.t and stated volume solids 244 sq.ft/US gallon at 5 mils d.f.t and stated volume solids
Practical Coverage	Allow appropriate loss factors
Method of Application	Airless Spray, Air Spray, Brush, Roller

Drying Time

			Overcoating Interval with recommended topcoats	
Temperature	**Touch Dry**	**Hard Dry**	*Minimum*	*Maximum*
5°C (41°F)	6 hours	8 hours	8 hours	Extended[1]
15°C (59°F)	4.5 hours	6 hours	6 hours	Extended[1]
25°C (77°F)	3 hours	4 hours	4 hours	Extended[1]
40°C (104°F)	1.5 hours	2.5 hours	2.5 hours	Extended[1]

[1] On other undercoats consult Interfine 979 Recommended Working Procedures or Interspec for specific details.
The drying times quoted have been determined at the quoted temperature and 50% relative humidity.
In warmer climates (>25°C (77°F)) and/or those that have a tendency for high relative humidity (>60%), an alternative curing agent is available which will allow improved product workability. See Product Characteristics.

REGULATORY DATA

Flash Point (Typical)	Part A 32°C (90°F); Part B 55°C (131°F); Mixed 35°C (95°F)	
Product Weight	1.33 kg/l (11.1 lb/gal)	
VOC	1.81 lb/gal (218 g/lt) 162 g/kg	EPA Method 24 EU Solvent Emissions Directive (Council Directive 1999/13/EC)

See Product Characteristics section for further details

SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:2000.

Primed Surfaces

Interfine 979 should always be applied over a recommended anti-corrosive coating scheme. The primer surface should be dry and free from all contamination and Interfine 979 must be applied within the overcoating intervals specified (consult the relevant product data sheet).

Areas of breakdown, damage etc., should be prepared to the specified standard (e.g. Sa2½ (ISO 8501-1:2007) or SSPC-SP10, Abrasive Blasting, or SSPC-SP11, Power Tool Cleaning) and patch primed prior to the application of Interfine 979.

Metallic Zinc Primed Surfaces

Ensure that the surface of the primer is clean, dry and free from contamination and zinc salts before application of Interfine 979. Ensure zinc primers are fully cured before overcoating.

APPLICATION

Mixing

Material is supplied in two containers as a unit. Always mix a complete unit in the proportions supplied. Once the unit has been mixed it must be used within the working pot life specified.

(1) Agitate Base (Part A) with a power agitator.
(2) Combine entire contents of Curing Agent (Part B) with Base (Part A) and mix thoroughly with power agitator.

Mix Ratio

4.00 part(s) : 1.00 part(s) by volume

Working Pot Life

5°C (41°F)	15°C (59°F)	25°C (77°F)	40°C (104°F)
3.5 hours	2.5 hours	2 hours	1.5 hours

Note: Pot life times are applicable to both curing agent grades.

Airless Spray	Recommended	Tip Range 0.28-0.53 mm (11-21 thou) Total output fluid pressure at spray tip not less than 155 kg/cm² (2204 p.s.i.)
Air Spray (Conventional)	Recommended	Gun DeVilbiss MBC or JGA Air Cap 704 or 765 Fluid Tip E
Brush	Suitable	Typically 50-75 microns (2.0-3.0 mils) can be achieved
Roller	Suitable	Typically 50-75 microns (2.0-3.0 mils) can be achieved
Thinner	International GTA007	Do not thin more than allowed by local environmental legislation
Cleaner	International GTA007	

Work Stoppages

Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with International GTA007. Once units of material have been mixed they should not be resealed and it is advised that after prolonged stoppages work recommences with freshly mixed units.

Clean Up

Clean all equipment immediately after use with International GTA007. It is good working practice to periodically flush out spray equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays.

All surplus materials and empty containers should be disposed of in accordance with appropriate regional regulations/legislation.

Interfine® 979

Acrylic Polysiloxane

PRODUCT CHARACTERISTICS

The detailed Interfine 979 Application Guidelines should be consulted prior to use.

Level of sheen and surface finish are dependent on application method. Avoid using a mixture of application methods whenever possible. Best results in terms of gloss and appearance will always be obtained by conventional air spray application.

When applying Interfine 979 by brush or roller, it may be necessary to apply multiple coats to achieve the total specified system dry film thickness.

This product must only be thinned using recommended International thinners. The use of alternative thinners, particularly those containing alcohols and ketones, can severely inhibit the curing mechanism of the coating.

After mixing a slight exotherm may be noted, which is typical of this product and is a result of chemical reaction.

Pot life times must not be exceeded even though the material may be still liquid and appear useable. It is good working practice that application should commence with full unopened units of material. Due to the moisture sensitivity with partially filled units of the curing agent component, there is a danger of reaction with atmospheric moisture which could adversely affect the performance of the final coating film. This phenomenon will be more prominent in the faster drying grade of curing agent where mixed product surface skinning in the container may occur more readily, particularly in warmer climates and / or those with high humidity.

Surface temperature must always be a minimum of 3°C (5°F) above dew point.

When applying Interfine 979 in confined spaces ensure adequate ventilation.

Care must be taken when spray applying multiple coats of Interfine 979 to ensure that a continuous wet film is applied and a minimum dry film thickness of 100 microns (4 mils) is achieved. Failure to do so may result in pinholing which will detract from ultimate appearance and performance.

Interfine 979 will cure satisfactorily at relative humidities between 40% and 85%. Curing will be slower at lower humidities and faster at higher humidities.

Condensation occurring during or immediately after application may result in a matt finish and an inferior film.

When overcoating after weathering or ageing, ensure the coating is fully cleaned to remove all surface contamination such as oil, grease, salt crystals and traffic fumes, before application of a further coat of Interfine 979.

Premature exposure to ponding water will cause colour change, especially in dark colours and at low temperatures.

Absolute measured adhesion of topcoats to aged Interfine 979 is less than that to fresh material, however, it is adequate for the specified end use.

This product is not recommended for use in immersion conditions. When severe chemical or solvent splashing is likely to occur contact International Protective Coatings for information regarding suitability.

Note: VOC values are typical and are provided for guidance purpose only. These may be subject to variation depending on factors such as differences in colour and normal manufacturing tolerances.

Low molecular weight reactive additives, which will form part of the film during normal ambient cure conditions, will also affect VOC values determined using EPA Method 24.

Alternative Curing Agent

For improved product workability in warmer climates and / or those with high relative humidity.

The drying times quoted have been determined at the quoted temperature and 50% relative humidity.

			Overcoating Interval with recommended topcoats	
Temperature	**Touch Dry**	**Hard Dry**	*Minimum*	*Maximum*
5°C (41°F)	10 hours	24 hours	24 hours	Extended[1]
15°C (59°F)	6 hours	12 hours	12 hours	Extended[1]
25°C (77°F)	4 hours	8 hours	8 hours	Extended[1]
40°C (104°F)	2 hours	6 hours	6 hours	Extended[1]

[1] On other undercoats consult Interfine 979 Recommended Working Procedures or Interspec for specific details.

SYSTEMS COMPATIBILITY

Interfine 979 can be applied over a limited range of primers and intermediates.

Suitable primers are:

Intercure 200	Intercure 200HS
Interzinc 52	Interplus 356
Interzinc 315	Interzinc 22
Interzinc 52HS	

Suitable intermediates are:

Intercure 420	Intergard 475HS
Interseal 670HS	Interzone 505
Interzone 954	

Interfine 979 must not be applied directly over Interzinc 52 low temperature grade cure (EPA176).

Absolute maximum overcoating intervals with Interfine 979 are dependent upon primer/intermediate. Interfine 979 Recommended Working Procedures must be consulted prior to use.

Interfine 979 should only be overcoated with itself.

Interfine® 979

Acrylic Polysiloxane

ADDITIONAL INFORMATION

Further information regarding industry standards, terms and abbreviations used in this data sheet can be found in the following documents available at www.international-pc.com:

- Definitions & Abbreviations
- Surface Preparation
- Paint Application
- Theoretical & Practical Coverage
- Interfine 979 Application Guidelines

Individual copies of these information sections are available upon request.

SAFETY PRECAUTIONS

This product is intended for use only by professional applicators in industrial situations in accordance with the advice given on this sheet, the Material Safety Data Sheet and the container(s), and should not be used without reference to the Material Safety Data Sheet (MSDS) which International Protective Coatings has provided to its customers.

All work involving the application and use of this product should be performed in compliance with all relevant national, Health, Safety & Environmental standards and regulations.

In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation.

If in doubt regarding the suitability of use of this product, consult International Protective Coatings for further advice.

PACK SIZE	Unit Size	Part A		Part B	
		Vol	Pack	Vol	Pack
	20 litre	16 litre	20 litre	4 litre	5 litre
	5 US gal	4 US gal	5 US gal	1 US gal	1 US gal
	For availability of other pack sizes, contact International Protective Coatings.				

SHIPPING WEIGHT (TYPICAL)	Unit Size	Part A	Part B
	20 litre	24.3 kg	4.4 kg
	5 US gal	49.6 lb	8.8 lb

STORAGE		
	Shelf Life	Part A: 12 months minimum at 25°C (77°F). Part B: 6 months minimum at 25°C (77°F). Subject to re-inspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.

Important Note

www.international-pc.com

Valspar Industries GmbH

Informacja techniczna

EP-farba do gruntowania
Nr art. 39,0009-50
Nr art. 588.33.99 utwardzacz

Ausgabe 06/04 Rev. 2
390009-50 Sch

Charakterystyka: Dwuskładnikowa farba epoksydowa, zawierająca rozcieńczalnik organiczny, schnąca na powietrzu i w suszarce. Nie zawiera chromu i ołowiu..

Zastosowanie: Farba gruntująca dla konstrukcji żelaznych i stalowych, dla odpowiedzialnych systemów antykorozyjnych oraz jako warstwa gruntująca dla powierzchni ocynkowanych takich jak: kadzie transformatorów, pokrywy, konserwatory i radiatory.
Farba EP Art. nr. 39,009 – 50 została dopuszczona przez Firmy ABB i ALSTOM do malowania powierzchni wewnętrznych transformatorów.

Dane techniczne:

Wszystkie dane dotyczą farby zmieszanej z utwardzaczem (art. nr. 588.33.99) w stosunku wagowym 5:1. Dane określone zostały dla warunków znormalizowanych, 20°C i 65% wilgotności względnej.

Nr art.			**39,0009-50**
Kolor			biały
Stosunek mieszania, wagowy			5:1
		Prüfnormen nach DIN	
Gęstość	(g/cm³)	53217	1,45
Zawartość części stałych	(%)	53216	ca. 68
Objętość części stałych	(cm³ / kg)	53219	ca. 330
Objętość części stałych	(%)	53219	ca. 48
Wydajność teoretyczna przy 40 µm	(m² / kg)	55945	ca. 8,5
Lepkość		53219	strukturalna
Czas schnięcia przy 20 °C i 40 µm grubości warstwy suchej:			
Stopień 1		53150	po 20 minutach
Stopień 4		53150	po 5 godzinach
Stopień 6		53150	po 6 godzinach
Do zestawów z farbami **„Valspar“:**			EP, EPW, PUR, ACN
Osągalna grubość powłoki:	polewanie		40 µm
	natrysk		80 µm
Odporność na temp. -suche powietrze			do 150 °C
Max. czas magazynowania			12
Rozcieńczalnik specjalny : Art. nr.			39.0410

Wskazówki dotyczące przygotowania:

Powierzchni: Najlepiej metodą strumienio-ścierną wg. DIN 55928 część 4, stopień czystości Sa 2,5 - 3. Należy zachować uśrednioną wysokość nierówności R_z , zgodnie z normą DIN 4768 część 1 lub DIN ISO 8503 część 1. Im większa jest wysokość nierówności, tym grubsza musi być warstwa powłoki malarskiej, tak aby osiągnąć tzw. „wystarczające pokrycie wierzchołków nierówności powierzchni". Trwałość ochrona warstwy malarskiej zależy w znacznej mierze od dokładności przygotowania podłoża przed malowaniem.

Farby: w razie potrzeby należy używać rozcieńczalnika art.-nr. 39.0410:

Nakładanie pędzlem	Bez rozcieńczania. Tylko w wyjątkowych przypadkach
Natrysk metodą powietrzną	Ustawić odpowiednią lepkość farby przez dodanie 10- 20 % rozcieńczalnika. Dysza 1,5 - 1,8 mm / ciśnienie powietrza 4-5 bar
Natrysk Airless	Lepkość dostawcza. Rozcieńczać tylko w wyjątkowych przypadkach. Dysza 0,43-0,55 mm / kąt natrysku 40° (w zależności od wielkości obiektu), ciśnienie natrysku 150-200 bar.
Natrysk Airmix, Air-Coat	Lepkość dostawcza, ewentualnie ustawić odpowiednią lepkość farby przez dodanie 3 – 10 % rozcieńczalnika, dysza 0,28 - 0,45 mm / kąt natrysku 20 - 65° (w zależności od wielkości obiektu), ciśnienie natrysku 50 - 100 bar; ciśnienie powietrza wspomagającego 1-4 bar.
Czas przydatności zmieszanych składników przy 20 °C	około 12 godzin, w zbiorniku do polewania max. 8 godzin!
Temperatura pracy	min +5 °C!
Temp.obiektu / wilg.wzgl.	min +3 °C powyżej punktu rosy / max. 85 %!

Uwagi: Minimalny czas konieczny do nałożenia farby nawierzchniowej na bazie PUR lub ACN wynosi:
16 godz przy 20 ^{0}C temp. obiektu 2 godz. przy 40 ^{0}C temp. obiektu, 1 godz. przy 60 ^{0}C temp. obiektu.
Nałożenie farby nawierzchniowej EP, przy temp. obiektu 20 ^{0}C, możliwe jest najwcześniej :
-przy grubości warstwy suchej 40µm po 4 godz, -przy grubości warstwy suchej 80µm po 8 godz.
Przy temperaturach +5,+10 ^{0}C należy stosować "szybki" utwardzacz Art.nr. 39,0809
Grubość powłoki suchej przy malowaniu wnętrza transformatora nie może przekraczać 80 m

Przykładowy zestaw warstw malarskich:

Farbą EP można kilkakrotnie przemalowywać powierzchnię gruntowaną.

np.:	farba do gruntowania EP biała	nr art. 39,0009-50	
	farba międzywarstwowa EP	nr art. 39,0075 -50	
	farba nawierzchniowa ACN	nr art. 41, 7633	lub
	farba do gruntowania EP biała	nr art. 39,0009-50	
	farba międzywarstwowa EP z miką	nr art. 39,0915-F	
	farba nawierzchniowa ACN	nr art. 41,7633	

Do malowania nawierzchniowego można stosować wszystkie farby - wymienione w pozycji na stronie pierwszej - Do zestawów z farbami **„Valspar"-**
Dane techn. dot. farby międzywarstwowej i nawierzchniowej zawarte są w odrębnych informacjach.

Dane bezpieczeństwa:	**farba bazowa: 39,0009-50**	**utwardzacz:588.33.99**
Temperatura zapłonu	24°C	24 °C
Klasa zagrożenia wg VbF	nie dotyczy	A II
Przepisy transportowe wg ADR/RID	patrz nadruk na opakowaniu lub „Karta danych bezpieczeństwa"	
Znakowanie wg EWG 88/379	patrz nadruk na opakowaniu lub „Karta danych bezpieczeństwa"	

Środki bezpieczeństwa: Przy stosowaniu produktu należy zachować wszelkie środki ostrożności obowiązujące w odniesieniu do materiałów malarskich, wynikające z „Karty danych bezpieczeństwa". Są to np.: „Przepisy dot. zapo-biegania nieszczęśliwym wypadkom" VBG 23, Branżowego Stowarzyszenia Przemysłu Chemicznego.

Niniejsza publikacja unieważnia wszystkie wcześniejsze wersje Informacji Technicznej dot. w/w farby.

UWAGA:
Pisemne lub ustne zalecenia techniczno-aplikacyjne dot. naszych produktów, przekazywane jako pomoc naszym Klientom, nie są zobowiązujące i nie stanowią podstawy do jakichkolwiek dodatkowych roszczeń z tytułu zawarcia umowy kupna. Zalecenia te opracowane zostały zgodnie z naszymi doświadczeniami i zgodnie z aktualnym stanem wiedzy naukowej i praktycznej. Nie zwalniają one Kupującego od samodzielnej kontroli przydatności naszego produktu do przewidzianego zastosowania. Ponadto obowiązują nasze ogólne warunki dostaw i płatności.

SECTION 14

APPENDIX H

TEST CERTIFICATES: 103500

(TESTING & CONFORMANCE - 4 PAGES)
(PARTIAL DISCHARGE REPORT – 2 PAGES)

iST POWER

IST POWER LTD

64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

Longley Lane, Sharston Industrial Estate, Wythenshawe, Manchester, M22 4RU Tel: +44 (0)161 428 9507

Email:- sales@istpower.com Web: www.istpower.com

TRANSFORMER TEST CERTIFICATE

CUSTOMER : Powell Engineering **ELECTRICAL SPEC :** 0105596

FAULT RATING : 830 **AMPS FOR** 3 **S** 50 **Hz** **SERIAL No :** 103500/1-01

RATED VOLTS : 13000

TEMPERATURE CLASS : **COOLING :** ONAN **VECTOR GROUP :** ZN

REFERENCE TEMP. °C :

THIS TRANSFORMER HAS BEEN TESTED IN ACCORDANCE WITH SPECIFICATION

BS EN 60076 : 2011

AND HAS SATISFACTORILY PASSED THE FOLLOWING TESTS

WINDING RESISTANCE AT 20 DEGREES C :

	WINDING Ohms
A - B	3.96
B - C	3.96
C - A	3.95

TEST RESULTS

NO LOAD LOSS :	**Watts**	261
NO LOAD CURRENT :	**%**	0.02
ZERO SEQUENCE IMPEDANCE :	**Ohms per ph.**	30.46

INDUCED OVERVOLTS : 200% AT 100Hz FOR 60 Seconds

SEPARATE SOURCE VOLTS WINDING : 50kV AT 50Hz FOR 60 Seconds

INSULATION RESISTANCE WINDING TO EARTH : 18.31 G Ohms

REMARKS :

TESTED : Alex Kaye **APPROVED :** Peter Jones

WITNESSED : _____ **DATE :** 15/11/2022

iST POWER

IST POWER LTD

64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

Longley Lane, Sharston Industrial Estate, Wythenshawe, Manchester, M22 4RU Tel: +44 (0)161 428 9507

Email:- sales@istpower.com Web: www.istpower.com

CERTIFICATE OF CONFORMANCE

CUSTOMER : Powell Engineering

IST ELECTRICAL SPEC : 0105596

SPECIFICATION : BS EN 60076 : 2011

SERIAL No : 103500/1-01

CUSTOMER PART No : **ISSUE :**
(If Applicable)

The goods identified by the above unique serial number have been tested and inspected to the above specification and have been proved to conform in all respects with your order.

APPROVED : Alex Kaye TEST ENGINEER

DATE : 15/11/2022

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64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

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Email:- sales@istpower.com Web: www.istpower.com

TRANSFORMER PARTIAL DISCHARGE REPORT

INDUCED OVER VOLTAGE TEST

Transformer :	0105596	**Low Volts :**	N/A
Serial Num :	103500/1-01	**High Volts :**	13 kV
Customer :	Powell Engineering	**Vector Group :**	ZN

PARTIAL DISCHARGE MEASUREMENTS

Supply : A-B-C AT 100HZ

PD Limit in pC	Level		PD at A	PD at B	PD at C
			pC	pC	pC
50	0.4 pu background	5.2 kV	12	27	26
-	1.2 pu 1 min	15.6 kV	10	19	21
250	1.58 pu 5 mins	20.5 kV	14	13	15
-	1.8 pu 1 min	23.4 kV	PASS	PASS	PASS
250	1.58 pu 1 hour (min 5)	20.5 kV	17	15	13
250	1.58 pu 1 hour (min 10)	20.5 kV	14	18	19
250	1.58 pu 1 hour (min 15)	20.5 kV	10	15	14
250	1.58 pu 1 hour (min 20)	20.5 kV	16	17	15
250	1.58 pu 1 hour (min 25)	20.5 kV	18	16	19
250	1.58 pu 1 hour (min 30)	20.5 kV	14	17	15
250	1.58 pu 1 hour (min 35)	20.5 kV	10	15	12
250	1.58 pu 1 hour (min 40)	20.5 kV	15	10	16
250	1.58 pu 1 hour (min 45)	20.5 kV	17	17	16
250	1.58 pu 1 hour (min 50)	20.5 kV	15	15	17
250	1.58 pu 1 hour (min 55)	20.5 kV	19	17	17
250	1.58 pu 1 hour (min 60)	20.5 kV	17	18	14
100	1.2 pu 1 min	15.6 kV	10	12	19
50	0.4 pu background	5.2 kV	12	10	12

TESTED: M Jackson **WITNESSED:** **DATE :** 16/11/2022

APPROVED : Peter Jones

This test complies to BS EN 60076 - 3:2013 **Form no. I053 issue 1**

iST POWER

IST POWER LTD

64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

Longley Lane, Sharston Industrial Estate, Wythenshawe, Manchester, M22 4RU Tel: +44 (0)161 428 9507

Email:- sales@istpower.com Web: www.istpower.com

TRANSFORMER TEST CERTIFICATE

CUSTOMER : Powell Engineering **ELECTRICAL SPEC :** 0105596

FAULT RATING : 830 **AMPS FOR** 3 **S** 50 **Hz** **SERIAL No :** 103500/1-02

RATED VOLTS : 13000

TEMPERATURE CLASS : **COOLING :** ONAN **VECTOR GROUP :** ZN

REFERENCE TEMP. °C :

THIS TRANSFORMER HAS BEEN TESTED IN ACCORDANCE WITH SPECIFICATION

BS EN 60076 : 2011

AND HAS SATISFACTORILY PASSED THE FOLLOWING TESTS

WINDING RESISTANCE AT 20 DEGREES C :

	WINDING Ohms
A - B	3.96
B - C	3.96
C - A	3.96

TEST RESULTS

NO LOAD LOSS :	**Watts**	267
NO LOAD CURRENT :	**%**	0.02
ZERO SEQUENCE IMPEDANCE :	**Ohms per ph.**	30.08

INDUCED OVERVOLTS : 200% AT 100Hz FOR 60 Seconds

SEPARATE SOURCE VOLTS WINDING : 50kV AT 50Hz FOR 60 Seconds

INSULATION RESISTANCE WINDING TO EARTH : 15.1 G Ohms

REMARKS :

TESTED : Alex Kaye **APPROVED :** Peter Jones

WITNESSED : _____ **DATE :** 16/11/2022

iST POWER

IST POWER LTD

64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

Longley Lane, Sharston Industrial Estate, Wythenshawe, Manchester, M22 4RU Tel: +44 (0)161 428 9507

Email:- sales@istpower.com Web: www.istpower.com

CERTIFICATE OF CONFORMANCE

CUSTOMER : Powell Engineering

IST ELECTRICAL SPEC : 0105596

SPECIFICATION : BS EN 60076 : 2011

SERIAL No : 103500/1-02

CUSTOMER PART No : **ISSUE :**
(If Applicable)

The goods identified by the above unique serial number have been tested and inspected to the above specification and have been proved to conform in all respects with your order.

APPROVED : Alex Kaye TEST ENGINEER

DATE : 16/11/2022

iST POWER

IST POWER LTD

64/66 Percy Road, Leicester, LE2 8FN (reg'd office) Tel: +44 (0)116 283 3321

Longley Lane, Sharston Industrial Estate, Wythenshawe, Manchester, M22 4RU Tel: +44 (0)161 428 9507

Email:- sales@istpower.com Web: www.istpower.com

TRANSFORMER PARTIAL DISCHARGE REPORT

INDUCED OVER VOLTAGE TEST

Transformer : 0105596 **Low Volts :**

Serial Num : 103500/1-02 **High Volts :** 13 kV

Customer : Powell Engineering **Vector Group :** ZN

PARTIAL DISCHARGE MEASUREMENTS

Supply : A-B-C AT 100HZ

PD Limit in pC	Level		PD at A	PD at B	PD at C
			pC	pC	pC
50	0.4 pu background	5.2 kV	29	39	40
-	1.2 pu 1 min	15.6 kV	41	49	44
250	1.58 pu 5 mins	20.5 kV	28	38	37
-	1.8 pu 1 min	23.4 kV	PASS	PASS	PASS
250	1.58 pu 1 hour (min 5)	20.5 kV	33	37	35
250	1.58 pu 1 hour (min 10)	20.5 kV	20	33	27
250	1.58 pu 1 hour (min 15)	20.5 kV	27	33	27
250	1.58 pu 1 hour (min 20)	20.5 kV	21	30	27
250	1.58 pu 1 hour (min 25)	20.5 kV	27	28	26
250	1.58 pu 1 hour (min 30)	20.5 kV	26	29	28
250	1.58 pu 1 hour (min 35)	20.5 kV	22	29	24
250	1.58 pu 1 hour (min 40)	20.5 kV	22	26	27
250	1.58 pu 1 hour (min 45)	20.5 kV	23	27	24
250	1.58 pu 1 hour (min 50)	20.5 kV	24	26	22
250	1.58 pu 1 hour (min 55)	20.5 kV	25	25	24
250	1.58 pu 1 hour (min 60)	20.5 kV	24	30	23
100	1.2 pu 1 min	15.6 kV	23	20	19
50	0.4 pu background	5.2 kV	20	18	17

TESTED: M Jackson **WITNESSED:** **DATE :** 16/11/2022

APPROVED : Peter Jones

This test complies to BS EN 60076 - 3:2013 **Form no. I053 issue 1**

iST

POWER