Kidde Fire Protection

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Kidde Inert Gas Systems. Product / Design Manual MA-01-9006-0100, rev. 11a Installation Procedure

Section 08

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Kidde Fire Protection

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1 Revision log

Revision	Page	Description	Date
11a	67	Added discharge hose part# for VdS approved system	06-01-2016
11	All	Other Inerts Added	02-01-2015
10	All	Company name changed	14-02-2008
10a	All	Grammar corrected	14-09-2012
4	25	Specification gaskets added, Supports rewritten, torque's added.	10-08-2002

2 Purpose

The following installation procedures should as a minimum be carried out as described. These procedures, in combination with the commissioning checks, are intended to ensure that the system satisfies the required designed properties and ensure the correct functionality/operation of the installed Kidde Inert Gas system.
The procedures are also intended to minimise the risk to personnel both during and after installation and to introduce the fitters briefly to the system they are installing.
The installer of a Kidde Inert Gas system shall be familiar with these procedures.

2.1 Safety

Safety is the primary concern!
Safe procedures shall be observed during handling of cylinders, installation and testing. Never assume that a cylinder is empty. Treat all cylinders as if they are fully charged.

Kidde Inert Gas cylinder valves are capable of producing a high discharge thrust from the valve outlet if not handled properly.
Remember that pressurised cylinders are extremely hazardous.
Always fit the safety protection cap before any movement the cylinder.
Failure to do so can result in serious bodily injury, death, and property damage.

Kidde strongly recommend that all persons receive Safe Cylinder Handling and installation training, to book a course telephone +44 (0) 7976712070

3 Responsibilities

3.1 Design engineer

It is the responsibility of the design engineer of a specific Kidde Inert Gas System installation to ensure that the requirements listed herein are incorporated into the project documentation and that detailed information/procedures/requirements are made available to the installer (see chapter 8).

3.2 Installer

It is the responsibility of the subcontractor to present his skilled labour force with these installation instructions and that detailed information/procedures are explained to those carrying out the installation (see chapter 8).
Further it is the responsibility that only technicians/fitters with valid certification execute the installation.

4 Modifications to procedures

Should the user have any comments or suggestions which could improve or clarify the content of this manual, they would be welcomed and should be forwarded to the manager of Kidde's suppression technical support department.

5 General Description, Inert Gas system

The extinguishing mechanism of a Kidde Inert Gas system is to reduce the normal Oxygen content in the air from 20.9% to approximately 12%.

In enclosures where the Inert Gas released reduces the Oxygen level to as low as 10%, personnel will still be safe but a 3-minute maximum time limit for exposure is then necessary.

It is, however, mandatory that the area is vacated immediately after start of discharge in order to avoid unnecessary exposure.

If for any reason occupants must remain within the enclosure for more than 5 minutes either during or after a discharge, this shall only be allowed when breathing apparatus is used. For shorter periods protection such as dust masks or ear defenders shall be used.

The Inert Gas system is normally monitored and controlled by the building fire alarm and control panel or a dedicated fire alarm and control panel (supplied by others) or a local fire alarm and control panel (depending on local approval requirements).

A standard cylinder bank normally holds cylinders for the initial/main discharge and, if required, the cylinders for a secondary or extended discharge.

The cylinders in a cylinder bank are installed in single, dual or triple row configuration.

The cylinders in the bank are individually connected to the release manifold assembly. The connection is made with high-pressure hoses and a check valve, one for each cylinder.

The check valves allow removal of one or more cylinders from the manifold without having a significant loss of Inert Gas should the remaining cylinders be discharged.

The release manifold assembly is equipped with a restrictor which reduces the initial pressure to approximately 60 bar. within the downstream pipework.

The piping system could protect the ceiling void, the room and the floor void simultaneously.

The system is normally released via an input from the fire detection and control panel.

The system can be released manually by removing the cutter pin and turning the handle/lever of the master cylinder manual release unit in the direction of the arrow (clockwise) .

The cylinders are each provided with either a pressure gauge/switch unit or a contact gauge unit. The "master" cylinder will include a solenoid valve release unit.

The pressure from the pneumatic actuator is channelled to pneumatic actuators on the slave cylinders (manual or pneumatic). The agent of the cylinder bank will be released almost simultaneously.

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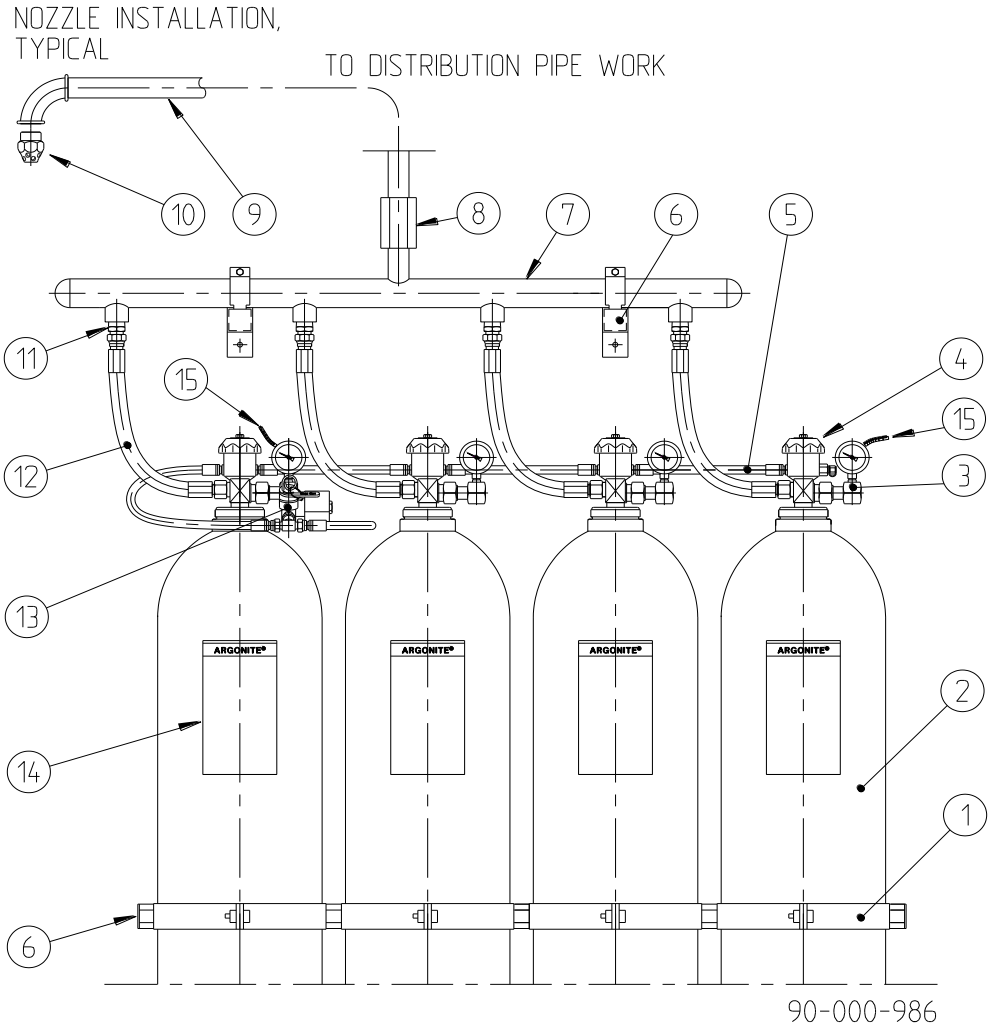
5.1 Single area cylinder bank arrangement, maximum 300 bar (typical)



1. Bracket for securing cylinder
2. Cylinder
3. Pressure gauge unit
4. Cylinder valve
5. Interconnecting pilot hose
6. Support for manifold.
7. Manifold
8. Restrictor
9. Distribution piping
10. Discharge nozzle
11. Check valve
12. Discharge hose
13. Solenoid valve actuator unit, with pressure gauge.
14. Label for cylinder
15. Single core cable to facilitate remote pressure monitoring
16. Rail for support of cylinders

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5.2 Distribution system

In distribution systems (where Inert Gas may be distributed to any one of a number of rooms from a common cylinder battery), the number of cylinders released is controlled by using a solenoid release unit and non-return valve for each “master” cylinder in the bank (with exception to the first master cylinder that actuates the entire bank).

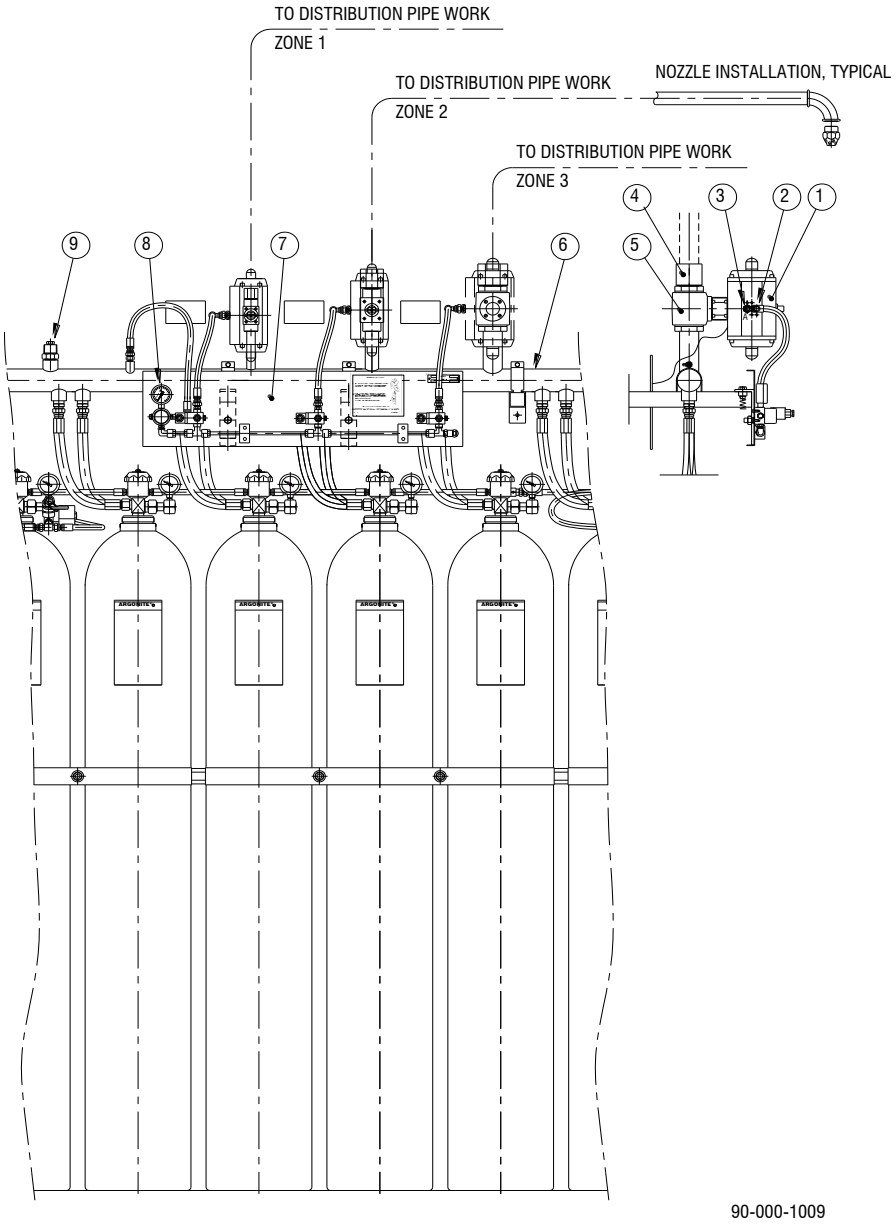
Non-return valves in the high-pressure pilot line prevent the discharge of excess cylinders into enclosures which do not require the entire content of the cylinder battery. A low-pressure pilot manifold incorporating low-pressure 3/2 way solenoid valves controls the pressure directed to the distribution valves. Each solenoid valve controls a specific distribution valve.

The pilot manifold receives propellant pressure from the discharge manifold.
The propellant pressure is reduced to 8 bar by a pressure-reducing valve.

When needed, the fire alarm and control panel will simultaneously energise the high-pressure release solenoid valve on the master cylinder in the battery and the associated low-pressure solenoid valve on the pilot manifold for the area where a fire is detected.

For safety reasons, distribution valves are supplied as dual action. The distribution valves shall be closed in the normal standby position and only open during a discharge. Closing the valve is a manual operation (they are not self-resetting).

5.3 Detail; cylinder bank distribution system, typical



1. Distribution valve actuator
2. Connection for ¼" Hi-flex hose, hose to be connected to nipple on site
3. Vent outlet, actuator
4. Restrictor
5. Distribution valve
6. Discharge manifold
7. Pilot manifold
8. Pressure reducing valve
9. Pressure relief device

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6 Technical Description

Inert Gas systems are delivered unassembled (as separate components).

Items to be supplied locally (excluded from normal scope of supply) include bolts for supports, distribution pipes and fittings as well as supports for pipe installation.

The Inert Gas cylinder battery must be installed and assembled as indicated on the relevant drawings. For details of individual components please refer to the relevant datasheet and/or installation instruction.

The system consists of the following main components:

- Distribution manifold arrangement
- Restrictor
- Inert Gas cylinders c/wvalves
- Contact pressure gauge units
- Solenoid valve/pressure gauge/switch units (sov's. 24 V DC 14 W)
- Discharge hoses
- Interconnecting hoses
- Check valves for interconnecting hoses
- Discharge nozzles

The solenoid actuator valve and the contact gauges (on one loop) are connected to the fire release and control panel either directly or via a junction box.

The contact gauges are to be connected using the single core cable provided.
The cable from the first contact and last contact in the loop is to be taken to the relevant connection terminals in the detection and control panel (cable to be supplied locally).

7 Functional Description

The general operation is described hereafter.

The Inert Gas cylinder valve is kept shut by the cylinder pressure and will remain open once operated until the cylinder is almost empty or pressure is removed from the pilot actuation line.

The system can be released in the following ways:

Automatic release:
By a signal from the fire alarm & control panel, initiated by detectors installed in the protected area.

Manual release:
In the event of an emergency, actuation may be accomplished directly by operating the manual actuator on the Master cylinder valve.

7.1 Materials

Manifold Welded, 200 bar	: Carbon steel. Sch. 80 Electro / Hot Dip Galvanised
Manifold Welded, 300 bar	: Carbon steel. Sch. 160 Electro / Hot Dip Galvanised
Storage cylinder	: Carbon steel, Painted Red, shoulder green/black.
Cylinder valve	: Brass with stainless trim
Pressure gauge/units	: Brass/Stainless steel
Hoses	: Steel reinforced rubber, couplings nickel plated or Sst 316
Instruments, instrument valve's tubing and fittings	: Brass/Stainless steel
Nozzle	: Brass

8 Reference Drawings

At the start of an installation, the listed drawings should as a minimum be in the position of the installer.

Title

Piping Isometric
Piping Plan
Cylinder Bank assembly
Installation procedure (this section)
Installation instruction IN 01-7172-004 supplied with each gauge unit

9 Tool Box

The installation of an Inert Gas system requires the use of tools;

The toolbox should include:
Warning signs “High Pressure Cylinder installation in progress” as required.
Cylinder trolley, carrying weight 80 l cylinder: 140 kgs, 140L cylinder 300 kgs.
Torque wrench with open keys: Key sizes, 36mm, 30mm, 27mm, 24mm, 20mm and 19mm
Fixed keys: Key sizes, 36mm, 30mm, 27mm, 24mm, 20mm and 19mm
Fixed keys shall be duplicated for adequate counter hold where required
Pipe wrenches in adequate size
Silicone spray, Würth Art no.: 0893221 or similar, for O’ring lubrication
Drilling machine
Drill pieces as required
Thread cutting machine
File(s)
Hacksaw
Gloves
Ammonium free leak detection liquid.

Note: *Propellant, Dinitrogen oxide or similar are excluded as it may discolor the brass surface.*

Screwdrivers as required
Curved Jaw locking Pliers, as required for temporary securing of cylinders.

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Measuring tools
Levelling tool
Vacuum cleaner for capture of drilling dust at delicate installations
Cleaning material such as a broom, oil suction powder/material etc.
1 Kg RAL 3000, Water based paint for repair Part. No. 15-9501-0000

10 Personal Safety

Installing an Inert Gas system requires the use of personal protection equipment (PPE).

The PPE should as a minimum include; safety shoes, helmet, safety glasses, lifting devices, cylinder trolley, etc.

Where welding is to be used; welders mask, welder's gloves, protection plate(s) and fire extinguisher(s).

11 Cylinder Battery Installation

Before the cylinder installation is started up it is strongly recommended that door(s) to the cylinder storage room are secured in the OPEN position, signs and warning tape should also be used to restrict access to the area, see example of a suitable sign below.

No entry !!!!
High pressure cylinder installation in progress

No other tasks should be performed simultaneously i.e. only personnel occupied in the replacement to be present

11.1 Location

The cylinders and associated fixing equipment shall be placed and installed according to the project specific cylinder bank assembly layout.

Note: As each 80L cylinder of 200 bar has a weight of approximately 110kg, each 80L cylinder of 300 bar has a weight of approx. 140kg and each 140L cylinder has a weight of approx. 300kgs it must be ensured that the floor can support the total load.

Cylinders shall only be moved or relocated by the use of a cylinder carrier.

Cylinder valve protection cap shall only be removed after the cylinder has been secured in its brackets**.**

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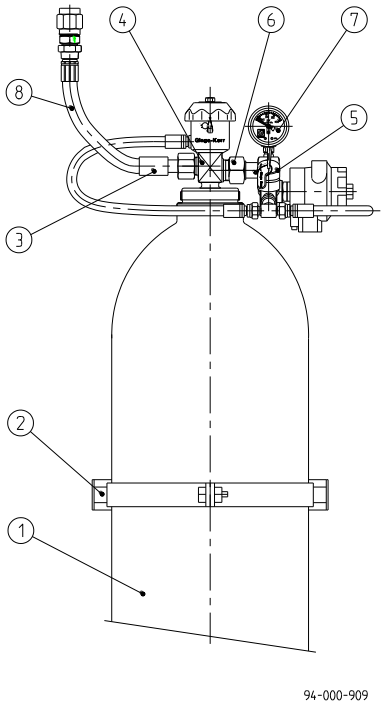
11.2 Floor loads

	WEIGHT PER METER OF 67.5 L CYLINDERS		
	150 bar	**200 bar**	**300 bar**
Single row	300 Kg	310 Kg	460 Kg
Double row	590 Kg	630 Kg	920 Kg
Triple row	890 Kg	940 Kg	1380 Kg
	WEIGHT PER METER OF 80.0 L CYLINDERS		
	150 bar	**200 bar**	**300 bar**
Single row	350 Kg	360 Kg	530 Kg
Double row	690 Kg	720 Kg	1050 Kg
Triple row	1040 Kg	1090 Kg	1580 Kg
	WEIGHT PER METER OF 140.0 L CYLINDERS		
	150 bar	**200 bar**	**300 bar**
Single row	N.A.	N.A.	680 Kg
Double row	N.A.	N.A.	1400 Kg
Triple row	N.A.	N.A.	2100 Kg

12 Typical cylinder assembly



Key:
(1) Cylinder (2) Fixing clamps (3) Pilot hose (4) Cylinder valve (5) Solenoid valve/manual release unit and (6) Connection swivel (incl. in release unit) (7) gauge/switch (incl. in release/gauge unit) (8) Discharge hose

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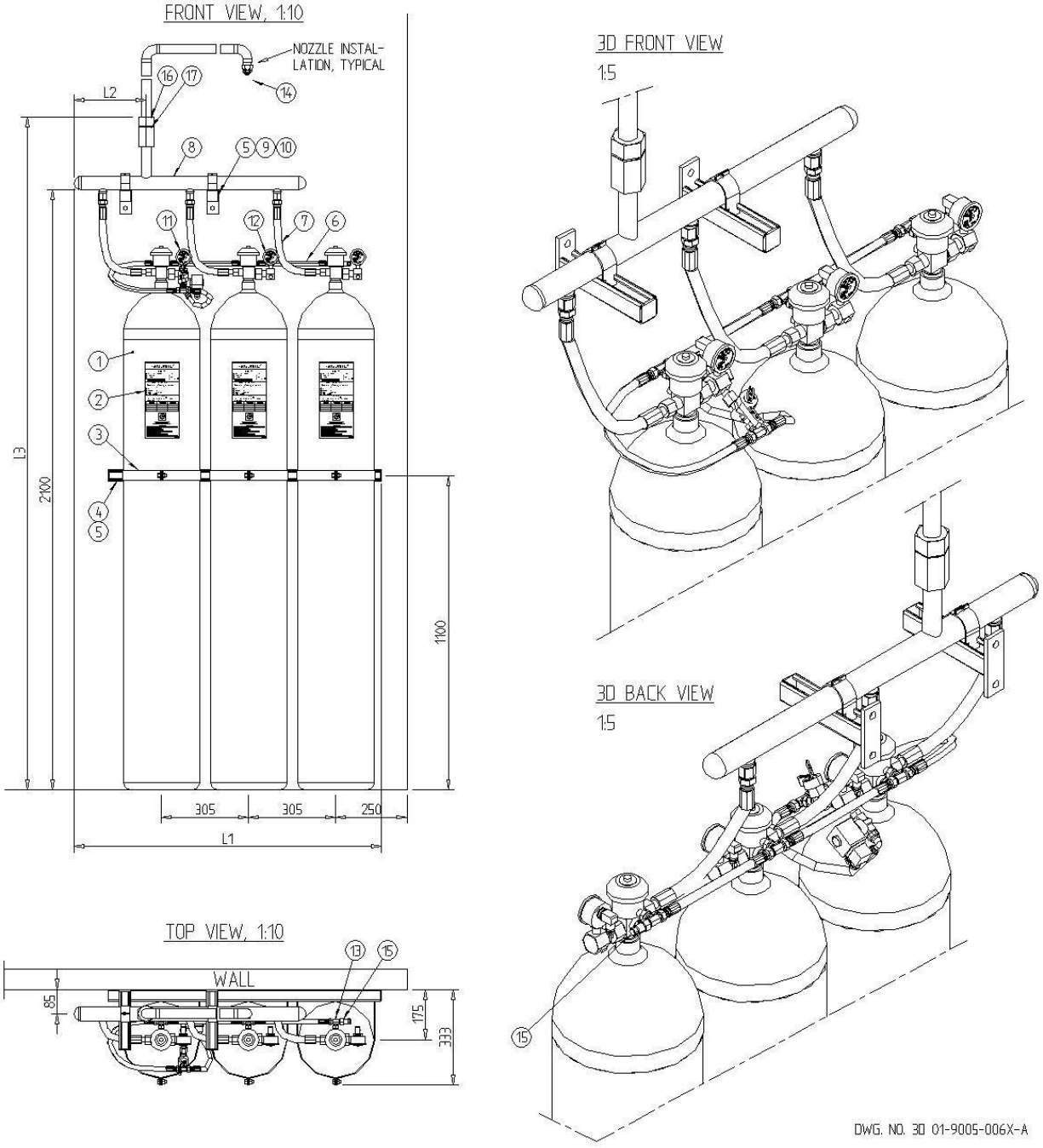
12.1 Details; Typical Battery Assembly, single row-single area



Key:
(1) Cylinder (2) Cylinder Label (3) Cylinder clamp (4) Wall bracket (5) End cap wall bracket (6) Pilot hose (7) Discharge hose (8) Manifold (9 &10) Bracket for manifold (11) Electric & manual Release unit (12) Gauge/switch unit (13) T-piece for pilot line (14) Discharge nozzle (15) Leak/vent unit (16) Adapter NPT/BSP (17) Restrictor

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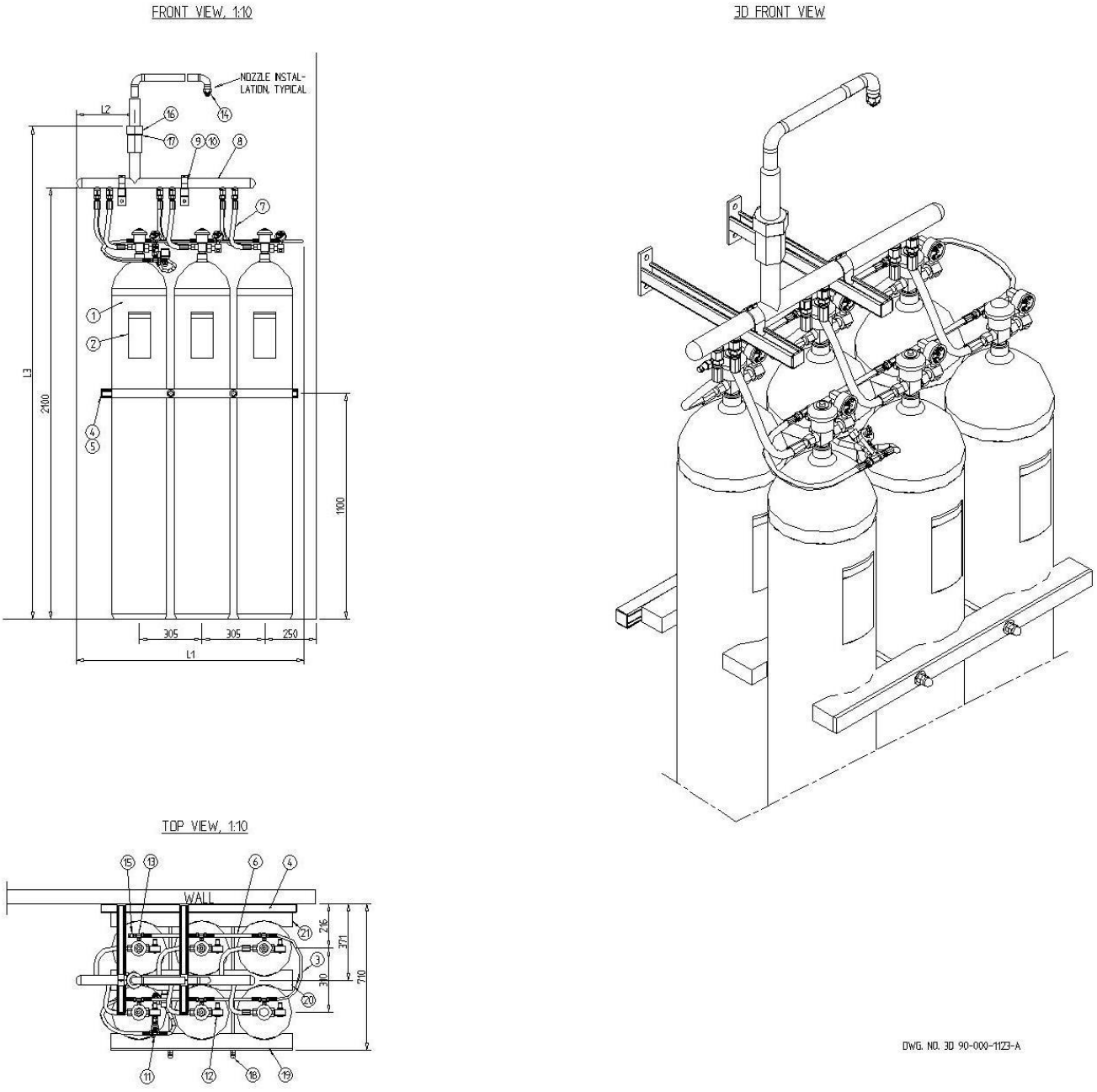
12.2 Details; Typical Battery Assembly, dual row-single area



Key:
(1) Cylinder (2) Cylinder Label (3) Pilot hose (4) Wall bracket (5) End cap, wall bracket (6) Pilot hose (7) Discharge hose (8) Manifold (9 &10) Bracket for manifold (11) Release unit (12) Gauge/switch unit (13) T-piece for pilot line (14) Discharge nozzle (15) Leak/vent unit (16) Adapter NPT/BSP (17) Restrictor (18) Clamping bolt (19) Clamping bar (20) Wooden spacer, 2x2 (21) Wooden spacer

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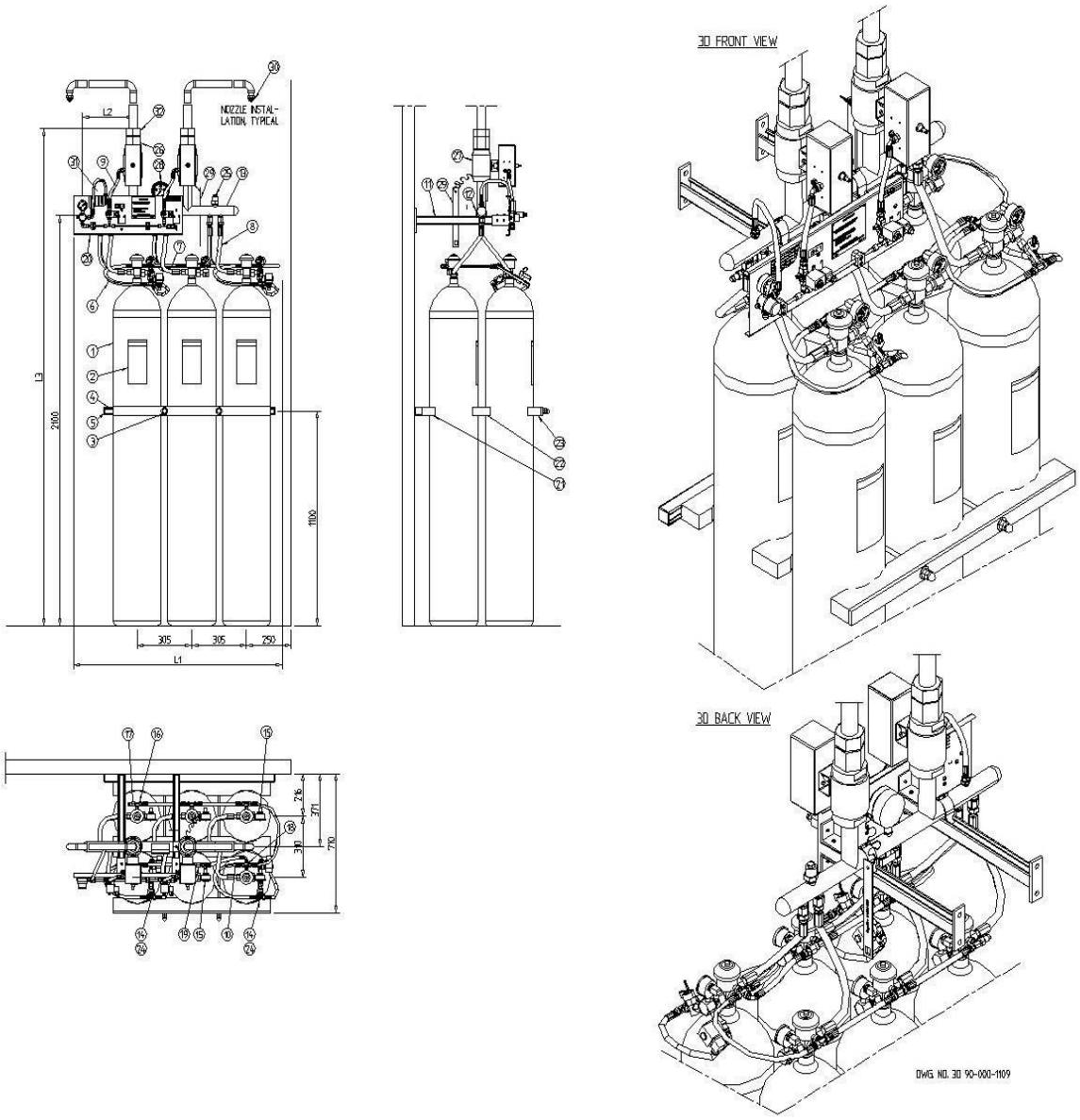
12.3 Details; Typical Battery Assembly, dual row, two areas



Key:
(1) Cylinder (2) Cylinder Label (3) Clamping bolt (4) Wall bracket (5) End cap, wall bracket (6, 7) Pilot hose (8) Discharge hose (9) Pilot hose diverter valve (10) Pilot hose (11) Bracket for Manifold (12) Clamp for manifold (13) Manifold (14) Release unit (15) Gauge/switch unit (16) T-piece for pilot line (17) Leak/vent unit (18) Cross (19) Non-return valve (20) Pilot manifold (21) Wooden spacer, 1x (22) Wooden spacer, 2x (23) Clamping bar, 1x (24) Manual release (25) Pressure release unit (26) Restrictor (27) Diverter valve (28) Pressure gauge (29) Handle for diverter valve (30) Discharge nozzle (31) Pilot hose pilot manifold (32) Adapter NPT/BSP

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13 Cylinder Battery Assembly

13.1 Securing Manifold

Before measuring the placement of the manifold brackets it is strongly recommended that a check of the cylinder height(s) is made. In recent years various amendments to the applicable standards for producing cylinders have resulted in 3 different heights of cylinders being produced. ***As a rule of thumb a distance of 280mm measured from the center of the outlet of the valve to the BOP of the manifold can be used*** (please refer to the applicable cylinder battery assembly drawing).

1. The channel iron/Unistrut supplied shall be fixed to a wall or solid structure by M12 expansion bolts with washer or similar, on steel structures they could be fixed by welding.

2. Bolts shall be tightened in accordance with the manufacturer's recommendation for the selected insert and the strength of the wall

3. Ensure that the brackets are horizontal, level and at the same height as indicated on the cylinder battery assembly drawing

4. Fix the manifold loosely to the channel iron/Unistrut by using the pipe clamps (pipe clamps are not to be tightened at this stage, as adjustment of the manifold may be required when cylinders are in place).

5. Connect the distribution pipe work to the relevant restrictor.
   Torque as required for the relevant pipe dimension, see also effective lengths of thread (par. 12) (counter hold with fixed spanner on the restrictor).

Note: It may be necessary to align the manifold outlet in the vertical position by a fixed pipe support.

6. Install distribution pipe work, see Chpt 16

13.2 Securing Cylinders

7. The channel iron/Unistrut supplied shall be fixed to a wall or solid structure by the use of M12 expansion bolts with washer or similar on steel structures they could be fixed by welding.

8. Bolts shall be tightened in accordance with the manufacturer's recommendation for the selected insert and the strength of the wall.

9. All sections of channel iron/Unistrut shall be installed horizontally and at the same height from the floor in order to obtain the best visual result

10. Fit clamping bolts into the channel iron

Note: ***Where bolt and nuts in AISI316 are used, the male threads to be applied silicone spray or "Molykote lacquer" before assembly.***

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11. If Unistrut profiles are used apply counter nut, washer and plate nut on the bolt, fit bolt into profile, tighten the nut loosely against the washer, use wooden spacer as template for exact location of bolts, and fix by tightening the nut against the washer. Apply max torque 10 – 15 Nm

Note: ***The installation of the manifold and the pipe work within the cylinder storage area/room must be completed before cylinders are moved into the cylinder storage area/room see below 13.1***

1. Fit wooden spacer on the clamping bolts

2. Slide cylinder into position

<u>As the cylinders are filled, care shall be taken during lifting/sliding/pushing into place.</u>

The high pressure cylinder valve is capable of producing high discharge thrust from the valve outlet if not handled properly. Remember that pressurised cylinders are extremely hazardous. Always ensure the protection cap is fitted before any movement of the cylinder. Failure to do so can result in serious bodily injury, death, and property damage

Fit clamping bar on cylinder bracket as appropriate. Tighten nuts on clamping bolts lightly at this stage (adjustment of cylinders may be required during hose installation). **Do not use the clamping bolt as a means of pressing the cylinder into the bracket.**

Note: ***Where bolt and nuts in AISI316 are used, the male threads to be applied silicone spray or "Molykote lacquer" before assembly***

13.3 Positioning Cylinders

Note: As the system relies on pressure taken from the cylinders to operate, it is essential that all permanently pressurised connections (or those under pressure during a discharge, including the cylinder valves) are checked for leakage during the installation. This includes actuation and outlet port valve, the gauge connection port on the valve and the various parts fitted into the contact gauge unit(s) and the pilot hoses.
Any leakage from the pressure bearing parts will/may jeopardise the operation of the release and/or reduce the time between re-filling the cylinders unnecessarily.
It is therefore mandatory that the checkpoints listed hereafter are completed and that the specified torques are applied to the connections.

For ease of positioning the cylinder, the valve the outlet port is marked by a label on the shoulder of the cylinder.

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Typical marking of valve outlet port.

After cylinder(s) secured in its / their brackets,

1. Remove transport cap from cylinder
   (store cap in a convenient place for future movement/transportation of the cylinder)

2. Ensure that the outlet of the cylinder valve is pointing to the left

3. Leak test outlet port of the cylinder valve by means of ammonium-free leak detection liquid. Visible leakage **shall** not occur (see 13.3.5 for locations to be leak tested)

4. Connect the discharge hose to the outlet of the cylinder and to the check valve connection point on the release manifold.
   Do not tighten the swivels on hose at this stage

5. Leak test actuation/gauge port of the cylinder valve by means of ammonium free leak detection liquid or spray, ensuring that there is no leakage (see 13.3.5 for locations to be leak tested)

6. Fit the T-piece for actuation to the connection point on the cylinder valve.
   Use an M19 fixed spanner. Apply torque 20 – 25 Nm.

Note: It may be necessary to align the cylinders during this operation in order to have a smooth run of the hoses, ensuring that sharp bends on the discharge hose are avoided (see permitted bending radius on relevant data sheet; 130mm or 160mm).

12. Fit interconnecting pilot hoses as indicated on the battery assembly drawing. Use an M19 fixed spanner. Apply torque 20- 25 Nm (counter hold required)

13. Tighten the swivels on the Hi-flex discharge hoses.
    Use M27 and M20 fixed spanners, apply torque 38 – 42 Nm (counter hold required on connection to check valve)

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14. Fit the bleed-valve to the actuator line at the location indicated on the assembly drawing. Use an M19 fixed spanner, torque to 20 – 25 Nm (counter hold required)

15. Tighten the nuts on the clamping bolts securing the cylinders.
    Use M24 & M20 fixed spanners, torque to 40 – 45 Nm
    Do not use the clamping bolt as a means of pressing the cylinder into the bracket.

16. Fit protecting nut on free thread end, only tighten slightly.

17. Tighten the pipe clamps for the distribution manifold.
    Use an M20 fixed spanner, torque: 20 – 25 Nm (counter hold required).

Note: ***Should a cylinder installation need to be left at any time unless an emergency the cylinder(s) to be temporarily secured by attachment of a wooden spacer and secured by use of a locking Pliers or similar***

No cylinder not hosed up to the manifold shall be left without safety cap on.

Diverter valve system, see also 14.6

18. Mount the pilot manifold for diverter valves on the brackets holding the discharge manifold, location as indicated on the cylinder bank assembly drawing, use the supplied M12 bolts and nuts. Tighten appropriate.

19. Connect pilot hose from the solenoid valve(s) on the pilot manifold to inlet on the diverter valve(s) as indicated on the cylinder battery drawing. Use an M19 fixed spanner. Apply torque 20- 25 Nm (counter hold required)

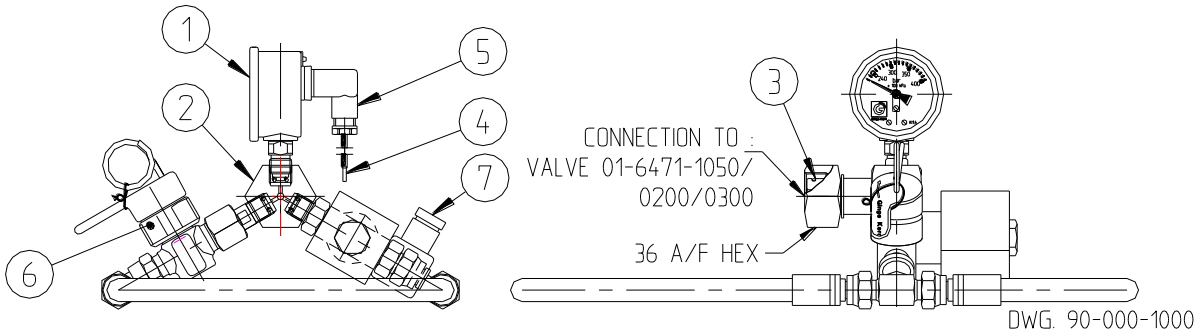
20. Connect pilot hose from pressure regulator on the pilot manifold to outlet on the discharge manifold. Use an M19 fixed spanner. Apply torque 20- 25 Nm (counter hold required)

13.4 Pressure Gauge Units for Valve Type 01-6471-0x00

Fit pressure gauge units as indicated on the battery assembly drawing.

Note: *The pre-assembled unit shall not be tampered with, as any adjustment to components pre-fitted to the connector block will lead to a leak.*

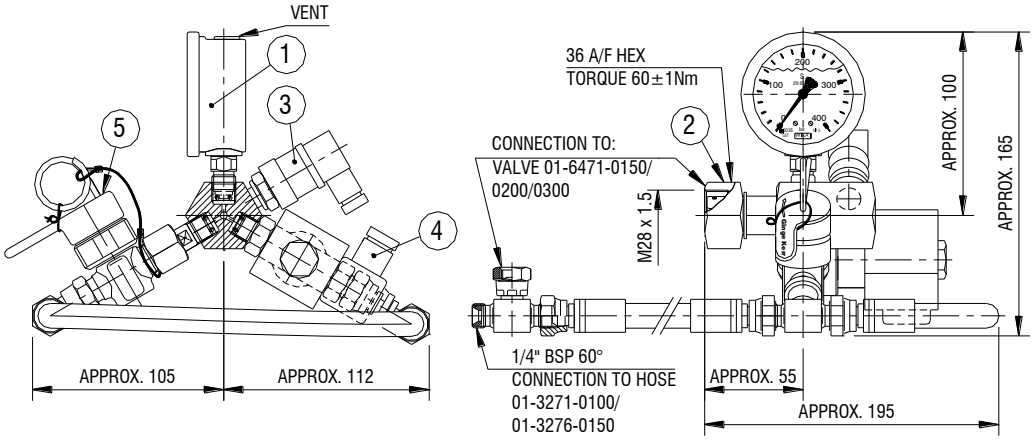
13.4.1 Contact gauge release units, 01-7172-XXXX



Key:
(1) Contact pressure gauge (2) Connection block (3) Connecting swivel (4) Single core cable (5) Connector for contact gauge (6) Manual release (7) Electrical connector for solenoid valve

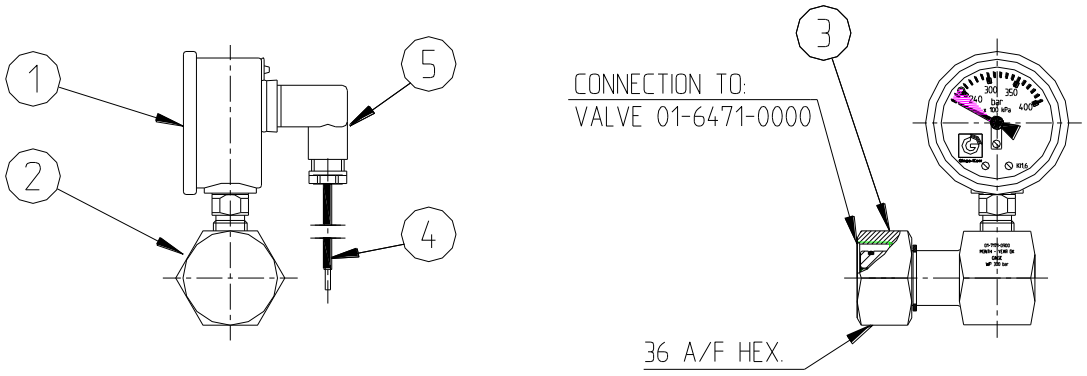
13.4.2 Release Units, Gauge/switch 01-7172- 7xx0

Mainly used in maritime systems and in systems where severe vibrations may be present.



Key:
(1) Pressure gauge, (2) Connection block, (3) Pressure switch, (4) Connector for solenoid valve, (5) Manual release.

13.4.3 **Contact Pressure Gauge 01-7171-XXXX**

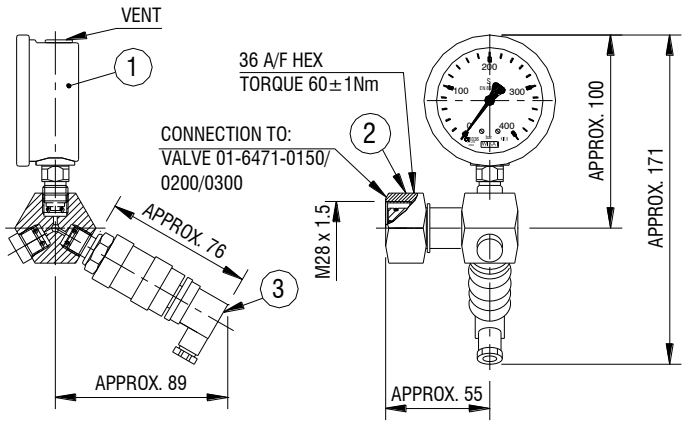


Key:

(1) Contact pressure gauge (2) Connection block (3) Connecting swivel (4) Single core cable (5) Connector for contact gauge

13.4.4 **Pressure Gauge/switch Units 01-7171-7xx0**

Mainly used in maritime systems and in systems where severe vibrations may be present.



Key:
Pressure gauge, (2) Connecting swivel, (3) Pressure switch.

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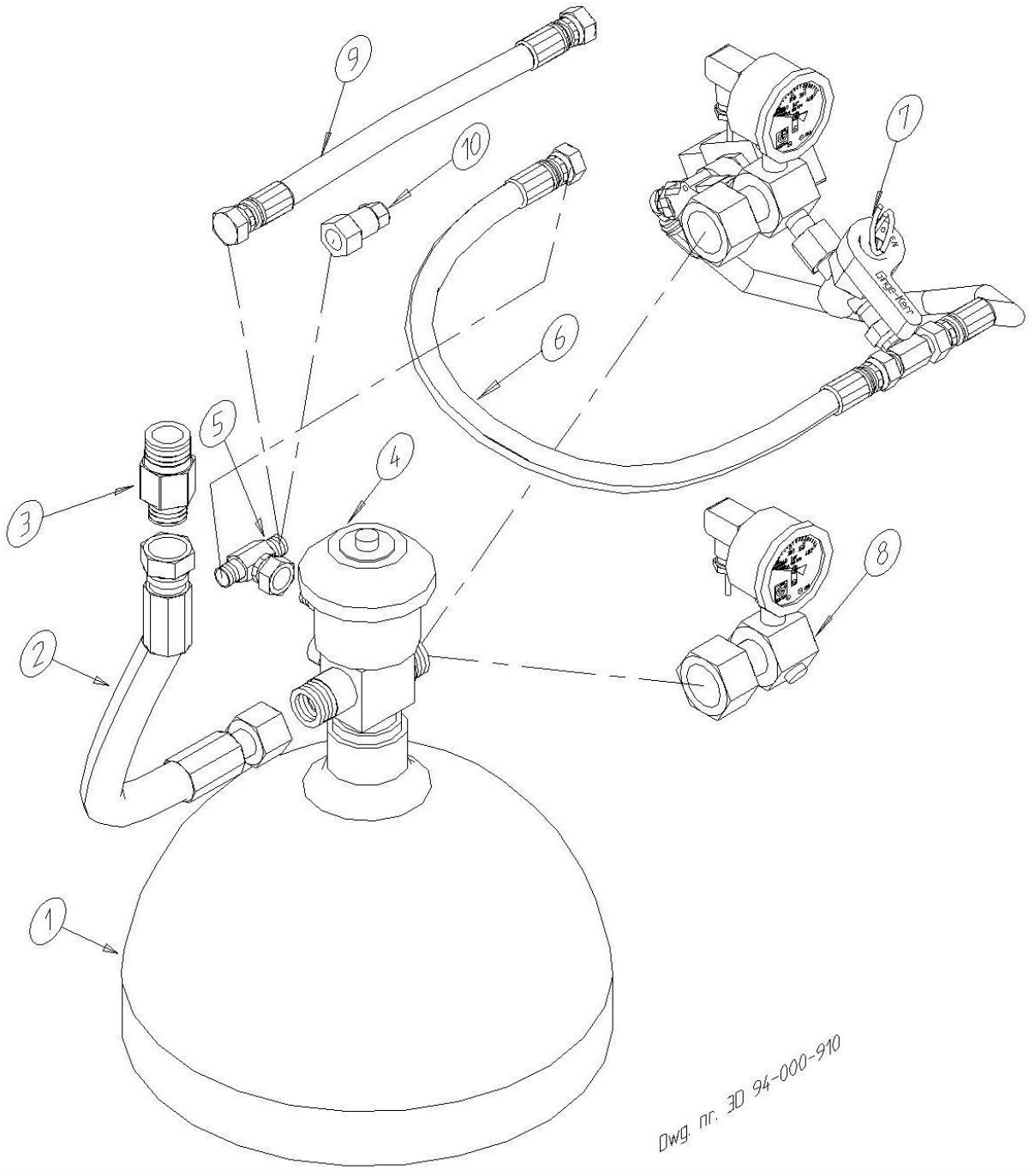
13.4.5 **Typical Cylinder Accessory Assembly**



Key:
(1) Cylinder (2) Discharge hose (3) Check valve on manifold (4) Cylinder valve (5) T-piece for pilot hoses (6) Pilot hose from release unit (7) Gauge/switch release unit (8) Gauge/switch unit (9) Interconnecting pilot hose (10) Leak vent valve (on last cylinder in the battery, diverter valve system see cylinder battery drawing).

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13.4.6 Securing Gauge / Release Units

Pressure gauge and solenoid units for 150, 200 bar and 300 bar systems are installed on the cylinder in the following way:

1. Ensure O-ring in connecting swivel is in place and lubricated.
   If lubrication is missing use silicone spray (Würth Art no: 0893221 or similar).

Note: *As the unit seals against the cylinder valve with an O-ring, it is essential that the inlet port and the lubricant used are absolutely free from dirt and other impurities. Use always clean fingers/tools.*
It is paramount that that only the O'ring be lubricated; excessive lubricant in the valve port will enter into the solenoid valve itself when pressurised and may block the internal filter and thus jeopardise the performance.

2. Fit the complete unit on the cylinder valve, adjust gauge for vertical alignment, tighten swivel nut by hand until pressure is indicated on the gauge

Note: *The pre-assembled unit shall not be tampered with, as any adjustment to components pre-fitted to the connector block will lead to a leak. After the unit is pressurized no alignment adjustment shall be made as may jeopardize the resetting of the shredder valve in the cylinder valve coursing it from resealing.*

3. Secure connecting swivel by the use of an M36 A/F fixed wrench. Apply torque 60 ± 1Nm on units holding solenoid valve and 45 ± 1Nm on units holding only gauge. It may be required to counter-hold (by hand only) during tightening.

Note: *Do not turn unit after the swivel nut has been tightened.*
May result in broken O'ring or dislocation of the shredder valve in the cylinder valve.

4. Leak test all connections indicated on instruction sheet IN-01-7172-004 by means of ammonium-free leak detection liquid or spray, ensuring that there is no leakage

Note: The contact gauge unit and solenoid/contact gauge/release unit(s) shall be installed on cylinders as indicated on the assembly drawing.

5. The hose from the solenoid valve must only be fitted to the actuation port after the unit has been pressurised and checked to be leak-free through the open hose end. Use an M19 fixed spanner, apply torque 20 – 25 Nm (counter hold required).

6. The last cylinder in the battery, battery section (Diverter valve system) always to be fitted with a bleeder/leak valve 01-3388-0000 See typical 13.4.5

Recommendation:

When installing multi-row cylinder batteries it is recommended that the electrician is allowed to connect the single-core cable and the cable for the solenoid valves as soon as the first row of cylinders is in place. This will permit him easy access to the contact gauges and solenoid valve(s) on the cylinders in the inner row.

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13.4.7 **Alignment after pressurisation**

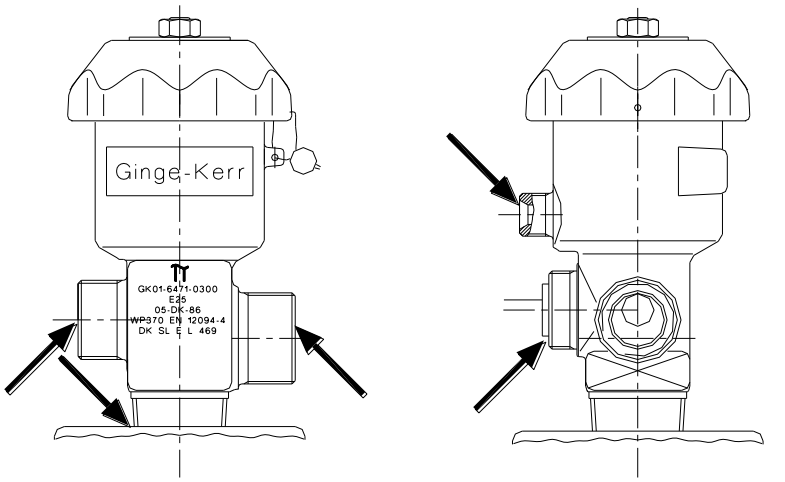
The construction of the contact gauge units allows for alignment/adjustment by hand until the swivel is tightened after which further alignment/adjustment ***shall not*** occur. The internal cylinder pressure helps to secure the unit(s) in position.

Should alignment/adjustment be required, loosen the swivel and position the unit as required, counter-hold by hand and tighten the swivel.

Note: *When the swivel is loosened the venting of the chamber will take place through the venting hole in the swivel.*
The venting of the chamber will give a loud hiss, which is normal. The venting will only involve the content within the chamber unless the valve is faulty.
The venting may remove the applied O'ring lubricant.
The O'ring must be lubricated before re-assembly to the valve port (use Shell silicone spray, Würth Art no: 0893221, or similar) (see note 13.3.4-1).

13.4.8 **Locations for leak testing**

The arrows on the sketch below indicate locations to be applied with ammonium-free leak detection liquid or spray in order to verify that no leak is present.
Should a leak be found the cylinder shall be returned to the filling station for refurbishment/replacement of valve and refilling.



LEAK TEST 90-000-1175

In addition to the positions shown above, those indicated on installation instruction IN01-7172-004 shall also be leak tested (see instruction sheet incl. in gauge packaging).

Should a leak be found from the gauge unit, the unit shall be dismantled and refurbished / returned for replacement.

-

14 Pilot Line Test

The pilot line shall be tested for overall tightness (it may not always be feasible to manually check each swivel connection individually).

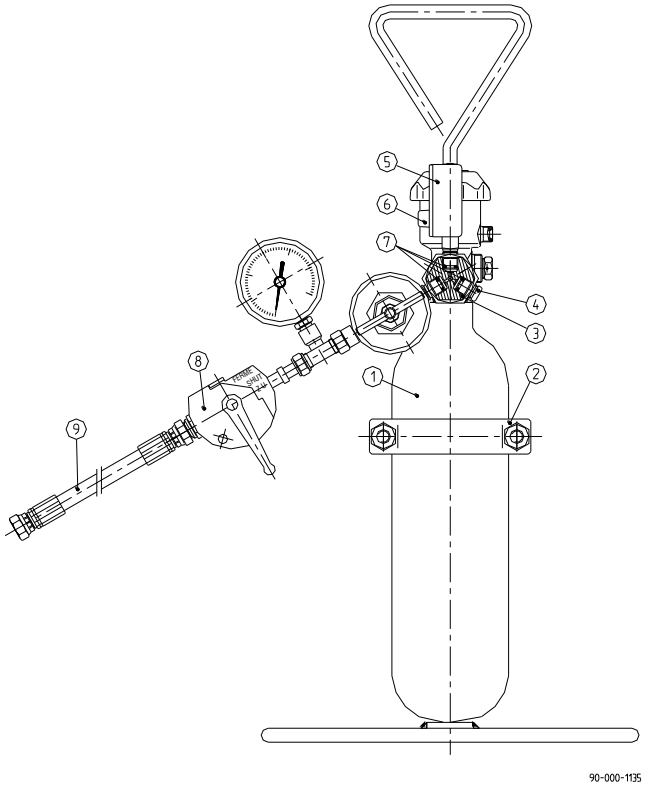
The unit shown below (part no: 01-9800-0000) will enable a pressure test of the entire pilot line to be carried out, giving a quick and easy indication of its integrity.

Note: Should alternative pressure equipment be used it shall only provide pressure in the pilot line of **2** bar as if higher pressure the cylinders will be released.

14.1 Description of Test unit

The unit consists of:
(1) Portable high-pressure cylinder, 2 litre x 200 bar (2) bracket (5) high pressure gauge unit (7) pressure reducing unit (8) shut off valve (9) Hi-flex hose, 3m

14.2 Using the test unit



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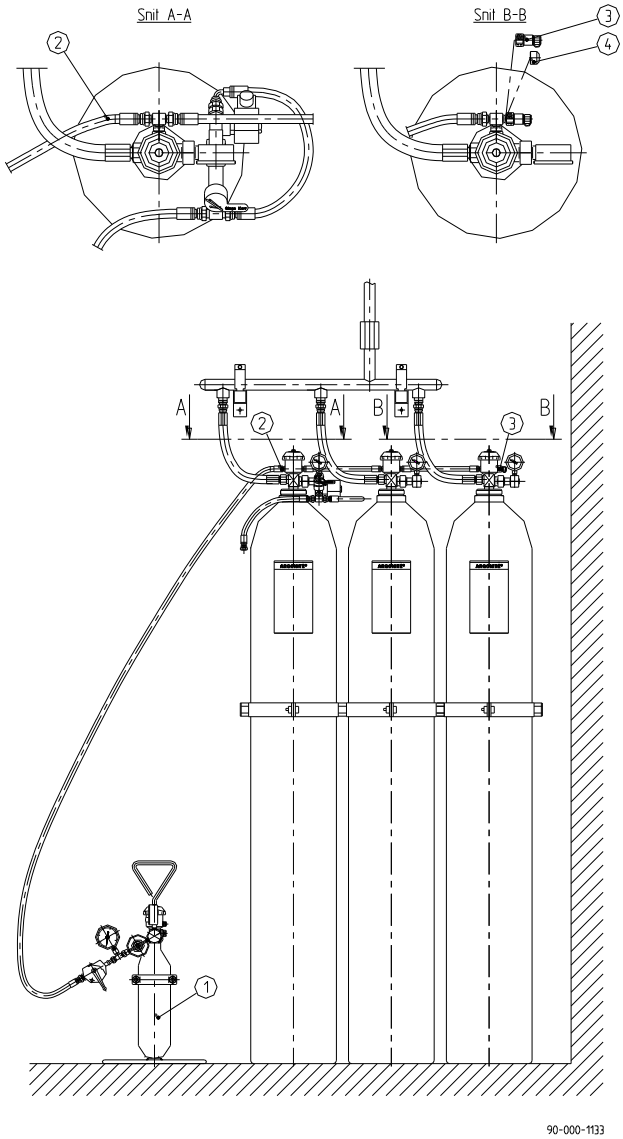


- Hi-flex hose from the test unit (1) to be connected to the connection port for the release solenoid valve (2) in the pilot line, vent/bleeder unit at the end of the pilot line (3) to be replaced with an end cap (4)

- The high-pressure gauge unit with regulator fitted with the shut off valve (pos. 8) in closed position...
- Open the valve on the test unit (1) and verify outlet pressure max. 2 bar, adjust pressure if necessary.
- Open the shut off valve (pos. 8) and inspect all connection points with leak spray or similar.
- All leaks must be rectified.
- Once the integrity of the pilot line has been assured, close the shut off valve (automatic vent), disconnect the Hi-flex hose, replace the end cap with the vent/bleeder unit, then connect the Hi-flex hose from the solenoid release valve to the port on the cylinder.
- Close the valve on the test unit.

-

14.3 Pressure Relief /Venting from Burst Discs

For installations where pressure relief is required from the burst discs, the following sketches are intended to show an acceptable method.

Venting from the burst discs can be taken to atmosphere or to the distribution pipework (downstream of the restrictor) for the largest area involved.

The piping used from the last hose connection to the distribution pipe work (or for penetrating building parts) shall always be selected in accordance with the specific project requirements.

The vent outlet to free air shall always be made in a manner that will prevent the 'jet' from causing personal injuries (i.e. the vent outlet shall be located at elevation of greater than 2m above ground level, with a bend away from any locations likely to be occupied.

Relief openings shall include protection against ingress of dust, dirt etc.

Penetration through building elements and the outer structure shall be made of materials which are corrosion-proof or are protected against corrosion in an acceptable manner.

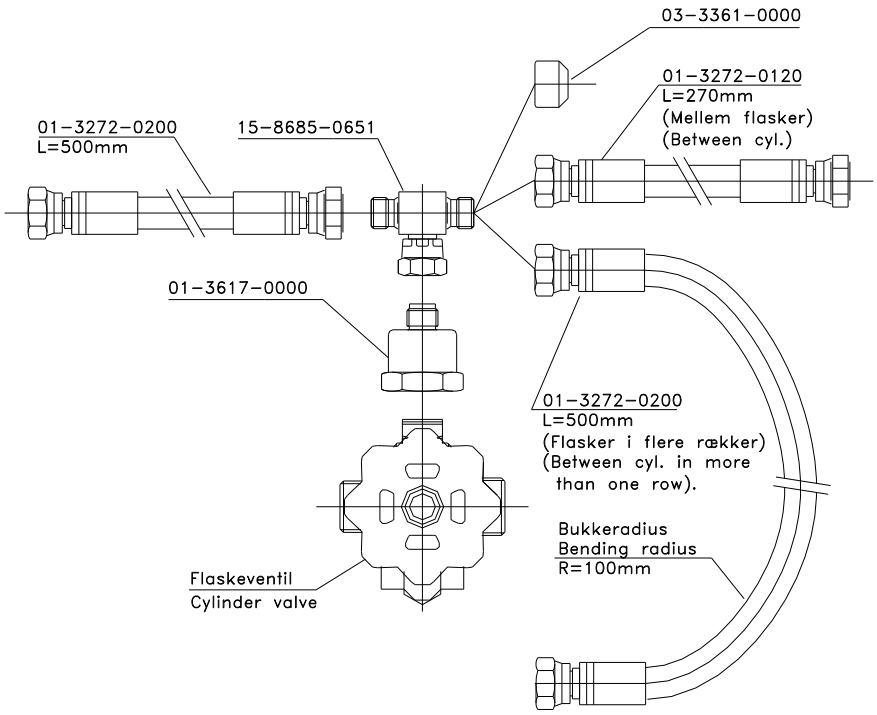
Care must be taken to properly insulate/seal between the pipe and the building element being penetrated. Sealing materials should be fire resistant and be non-conductive.

The penetration on both sides of the building element should be provided with an escutcheon plate selected in accordance with the existing architecture.

Note: ***Before adaptor 01-3617-0000 is fitted to the valve, the "coloured plastic cap" on the burst disc shall be removed.***

-

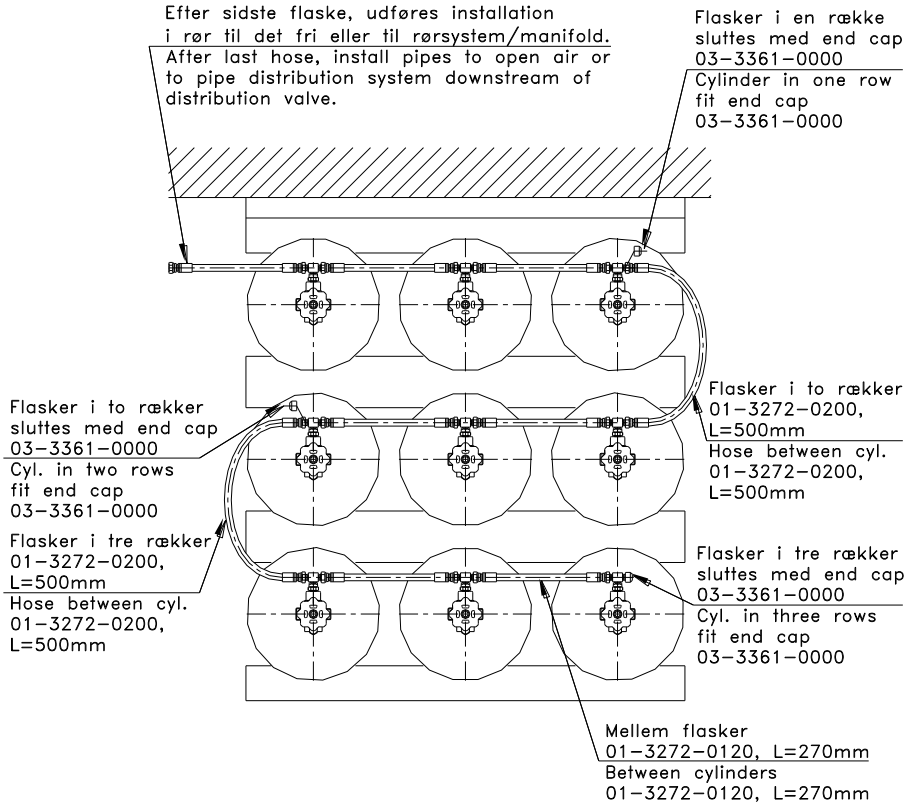
Montageanvisning af slange
for trykaflastning på ARGONITE flaske.
Installation of hoses for pressure relief
from bursting discs on ARGONITE cyl. valves.



IN 90-000-815/1

Eksempel på montage: se side 2 af 3
Sample of installation: see page 2 of 3

-



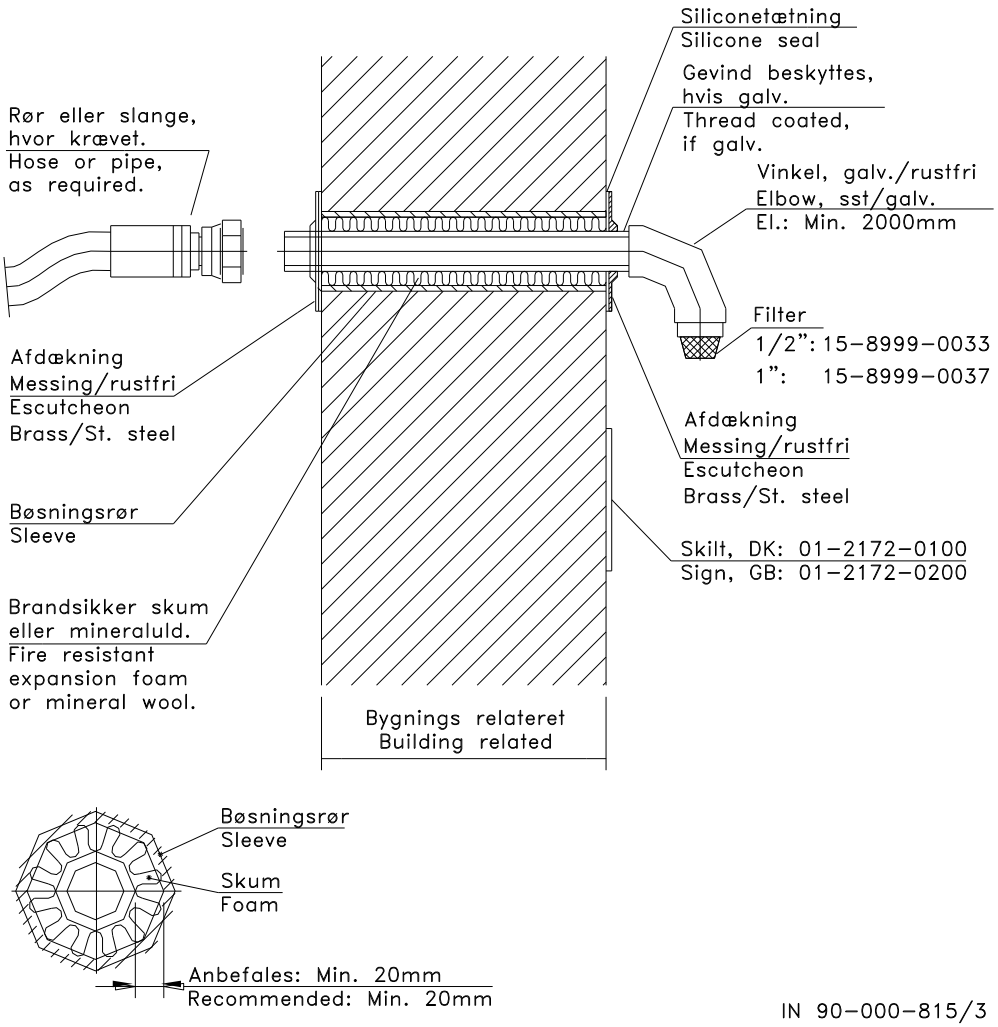
NB:
Afgangsslanger og slanger mellem aktuatorer ikke vist.

NOTE:
Discharge hoses and hoses between actuators not shown.

IN 90-000-815/2

-

Forslag til: Gennemføring til det fri.
Proposal for: Wall penetration.



IN 90-000-815/3

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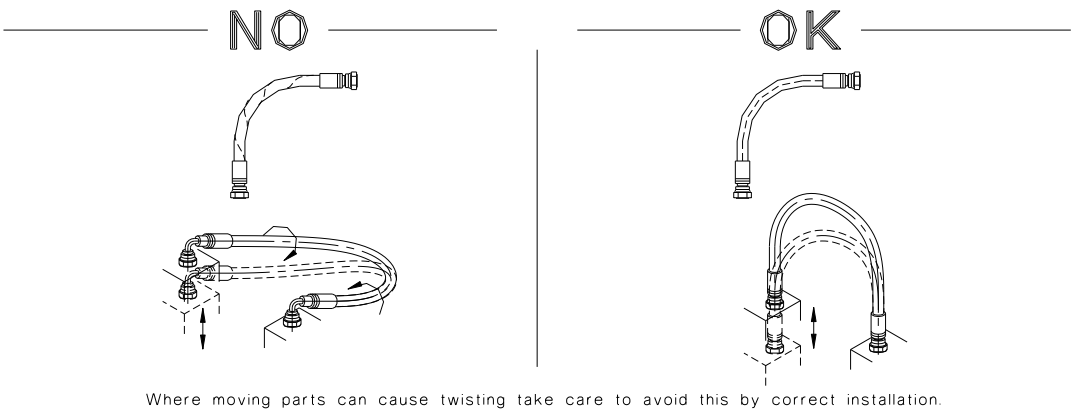
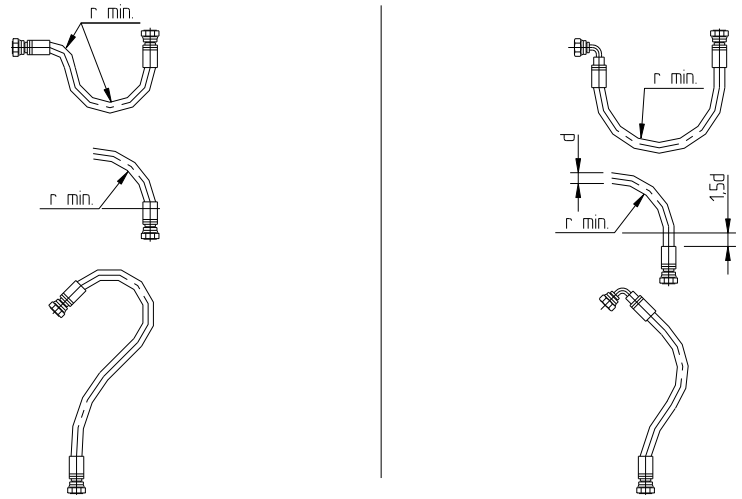
14.4 Installation of Hoses

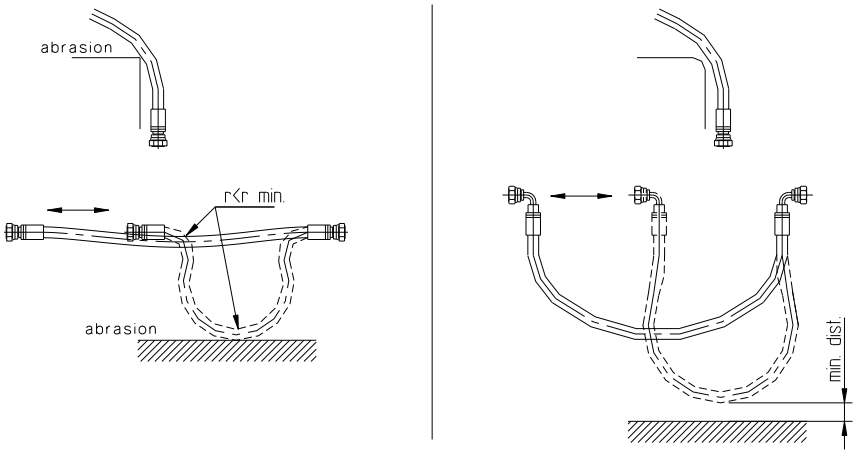
The hoses supplied have been designed to have a neat appearance once installed, but there are a few basic requirements which have to be met for correct installation (see sketches below). The minimum bending radius for each hose type refer to the relevant datasheet.



Where moving parts can cause twisting take care to avoid this by correct installation.



Do not begin to bend closer than 1,5 time "d" to the ferule.



Avoid contact with objects that can cause abrasion or damage. On moving applications, pay particular attention to avoid tensile stress or abrasion.

90-000-1007

14.5 Restrictor/Orifice

Fully assembled restrictors are supplied.

The restrictors are normally supplied pre-fitted to the discharge manifolds. However, in certain cases (single cylinder systems and/or where other requirements apply to an installation) the restrictor unit is supplied loose for fitting at site.
It is essential that the restrictor is installed strictly in accordance with the installation drawing, orifice size and direction of flow i.e. the restrictor for a location shall be installed in the pipe work for that location and the arrow shall point from high pressure (manifold) to low pressure (distribution piping).

The restrictor ensures that the stored pressure will be delivered to the distribution pipe work at an acceptable, predetermined pressure.

The restrictors available are shown in the following sections.

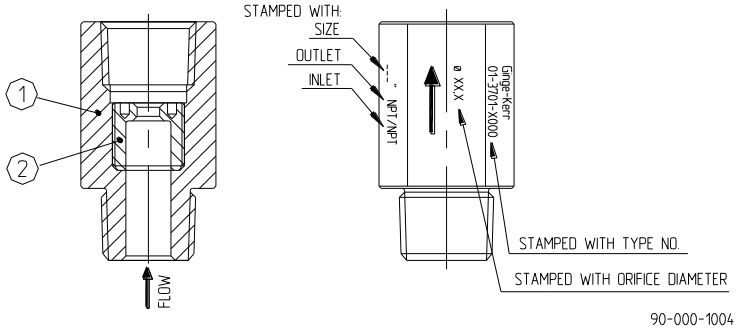
For connections from ½" up to 2" on the high-pressure side, restrictors are available as unit assemblies.

For larger dimensions, the restrictors fabricated in compliance with project requirements.

Restrictor assemblies for VdS certified systems see Chpt. 14.5.4

14.5.1 Restrictor for Socket Mounting

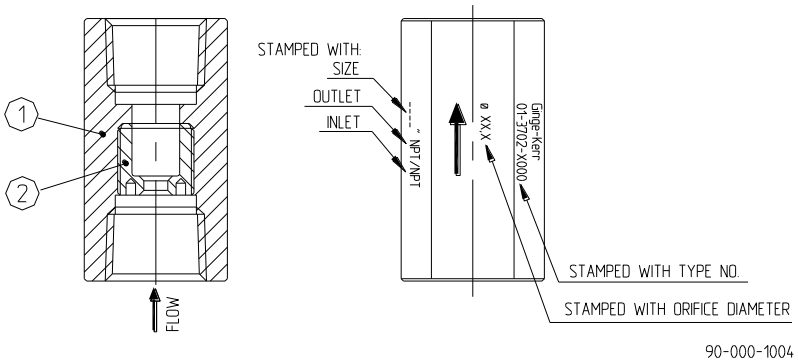
The restrictor for socket mounting is used with manifolds having a female outlet connection and for distribution valve assemblies. The restrictor is available threaded as NPT-NPT or NPT–BSP (see sketch below).



1. Restrictor body
2. Orifice plate

14.5.2 Restrictor for nipple mounting

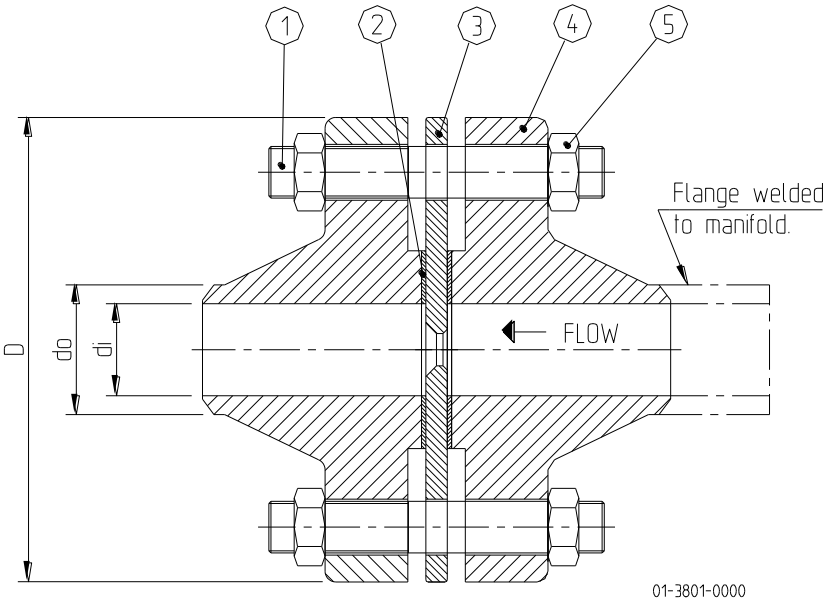
The restrictor for nipple mounting is used with manifolds having a Male outlet connection, typically for single area protection. The restrictor is available MA-FE threaded, NPT-NPT, and/or NPT –BSP. See sketch below.



1. Restrictor body
2. Orifice plate.

-

14.5.3 **Flanged Restrictor assemblies**



1. Bolt, Dimension and numbers acct. selected standard of flange
2. Gaskets: Size and quality selected acct. to upstream pressure.
   Spiral Wound gasket type 316/CS/GR or similar recommended.
3. Orifice plate, Dim. Acct. upstream pressure and calculated orifice.
4. Welded neck Raised face flanges selected acct. upstream pressure. (Class #1500 for 200 bar systems, Class #2500 for 300 bar systems)
5. Nut, Dimension and numbers acct. selected standard of flange

The connection to distribution pipe work to be done at Site.

See also drawing no. 90-000-1016.

14.5.4 **Restrictor assemblies VdS Certified systems.**

14.5.5 **Pressure reducing assembly, DRE-HD 300-F-XXX**

The orifice assembly is supplied fully assembled on the discharge/diverter manifold.
The pressure reducing orifice plate shall if demounted be re-installed between flanges supplied.
See required torque below.

The orifice plate shall be located as indicated on the project documentation.
Cylinder battery / pipe isometric installation drawings.

14.5.6 **Installation, DRE-HD 300-F-XXX**

The installation of the pressure reducing orifice plate shall be installed as shown in the below sketches i.e. the inlet site of the orifice plate and the drilling to be strictly observed.

-

Before installation it shall be verified that the orifice is a indicated on the pipe installation drawing, the orifice plate and the O-rings are undamaged. ***Any damaged parts shall not be installed.***

All bolts shall be inserted in the flange assembly before the bolts torqued up, see torque required below. Tightening to be done cross wise.

14.5.7 Technical Information, DRE-HD 300-F-XXX

Working pressure: Max. 370 bar

Test pressure: 555 bar

Medium: Inert gas

Flange acct.: SAE #6000, ISO 6164-2

Material: S355J2G3N

14.5.7.1 SAE flanged #6000 Threaded NPT for restrictor, DRE-HD 300-F-XXX

Dimension	Dimension	KFP	VdS
DN [mm]	DN ["]	Part no.:	Certificate Restrictor plate
15	½	6-01-3721-1000	
25	1	6-01-3721-2000	G304002
40	1½	6-01-3721-3000	
50	2	6-01-3721-4000	G304002

14.5.7.2 Bolt w/washer and nut for DRE-HD 300-F-XXX assembly.

Flange Dim.	Flange Dim.	No's Bolts	Bolt dim. DIN 912-8.8	KFP
DN [mm]	DN ["]	Pcs.	M x L [mm]	Part no.: Set:
15	½	4	M8 x 40	6-15-9090-1xxx
25	1	4	M12 x 55	6-15-9090-2xxx
40	1½	4	M16 x 60	6-15-9090-3xxx
50	2	4	M20 X 80	6-15-9090-4xxx

-

14.5.7.3 Spare O'ring for SAE flanges

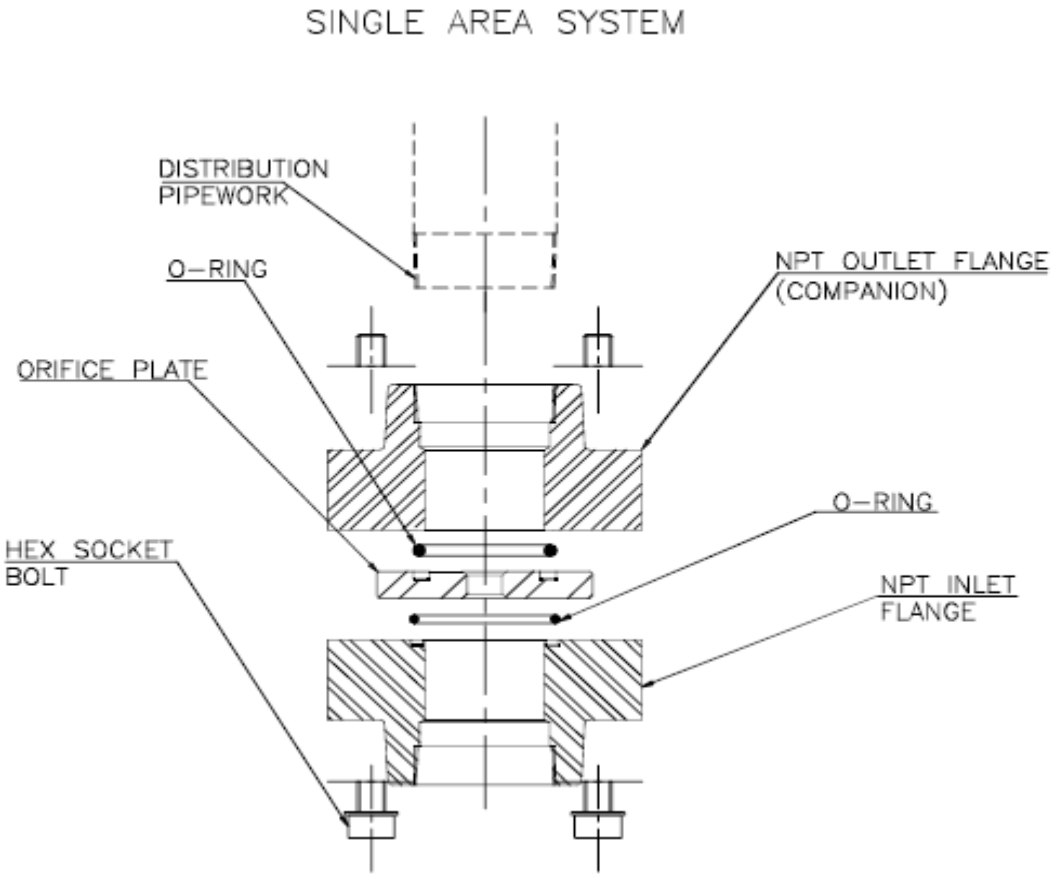
Flange Dim. DN [mm]	Flange Dim. DN ["]	Dim. O´ring OD x ID x h [mm]	KFP Part no.:
15	½	25,7 x 18,64 x 3,53	6-15-0181-11xx
25	1	39,98 x 32,92 x 3,53	6-15-0181-21xx
40	1½	54,28 x 47,22 x 3,53	6-15-0181-31xx
50	2	63,80 x 56,72 x 3,53	6-15-0181-41xx

14.5.7.4 Tightening torque for bolts

Flange Dim. DN [mm]	Flange Dim. DN ["]	Torque Nm
15	½	27
25	1	50
40	1½	140
50	2	174

-

14.5.7.5 Typical assembly DRE-HD 300-F-XXX, Single area system



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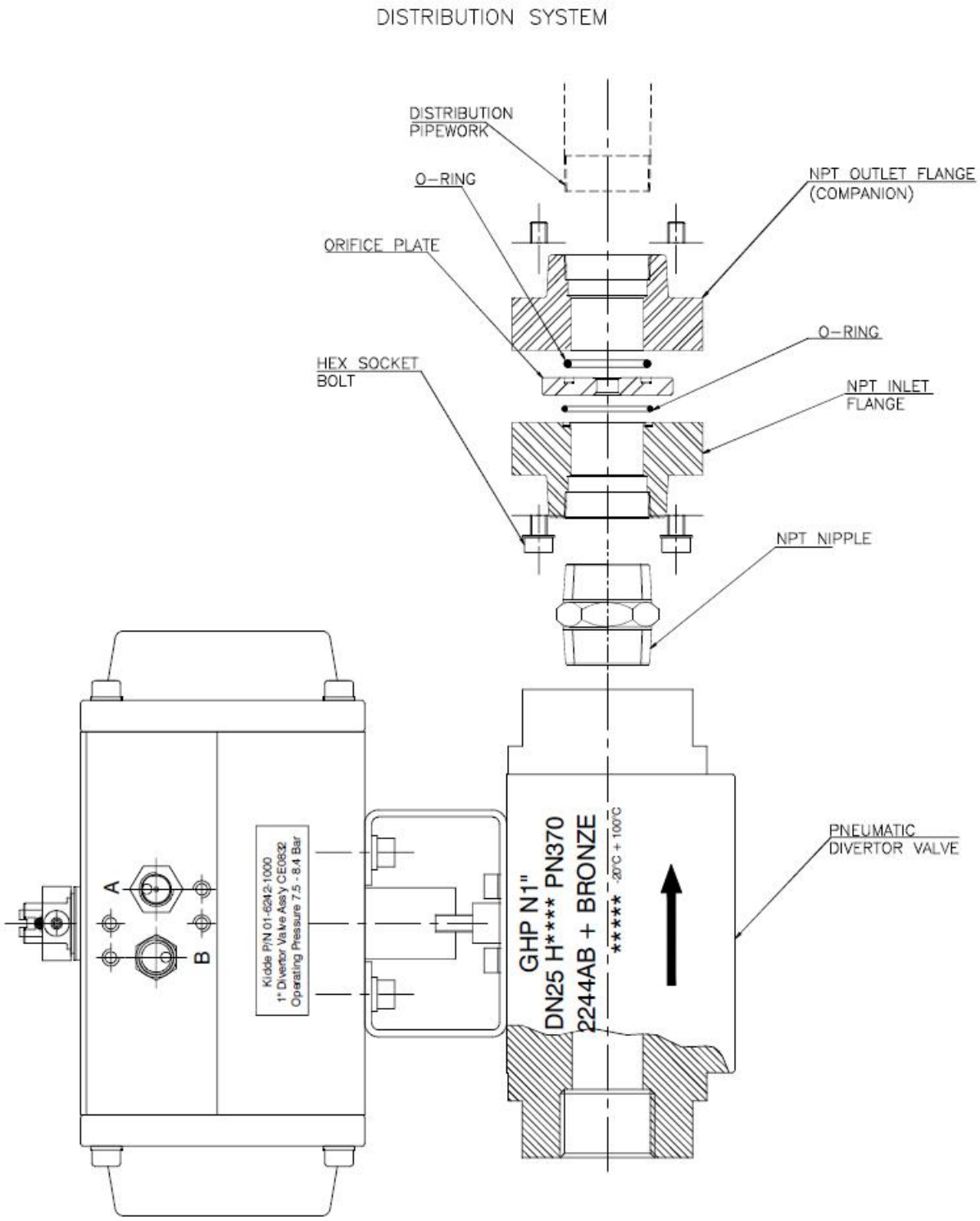
14.5.7.6 Typical assembly DRE-HD 300-F-XXX, Diverter valve system



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14.6 Diverter Valves

Diverter valves are normally supplied pre-assembled on the discharge manifold. The distribution valve will always be located on the high pressure side of the restrictor in order to keep the diameter as small as possible.
When the installation is complete, check that the diverter valves have been left in the closed position and the handle for closing the valve secured in an easily accessible place.
The handle must never be left on the valve.
The connection from the low-pressure pilot manifold to the inlet port to the actuator on the diverter valve must have been inspected for tightness at both ends.

Note: Never attempt to modify the actuator assembly (i.e. never open the actuator). Should the unit fail to operate as intended contact Kidde Products Ltd.

14.7 Pilot manifold

The low-pressure pilot manifold has been designed to fit directly onto the brackets holding the manifold (see sketch below).

Fixing accessories to be used:

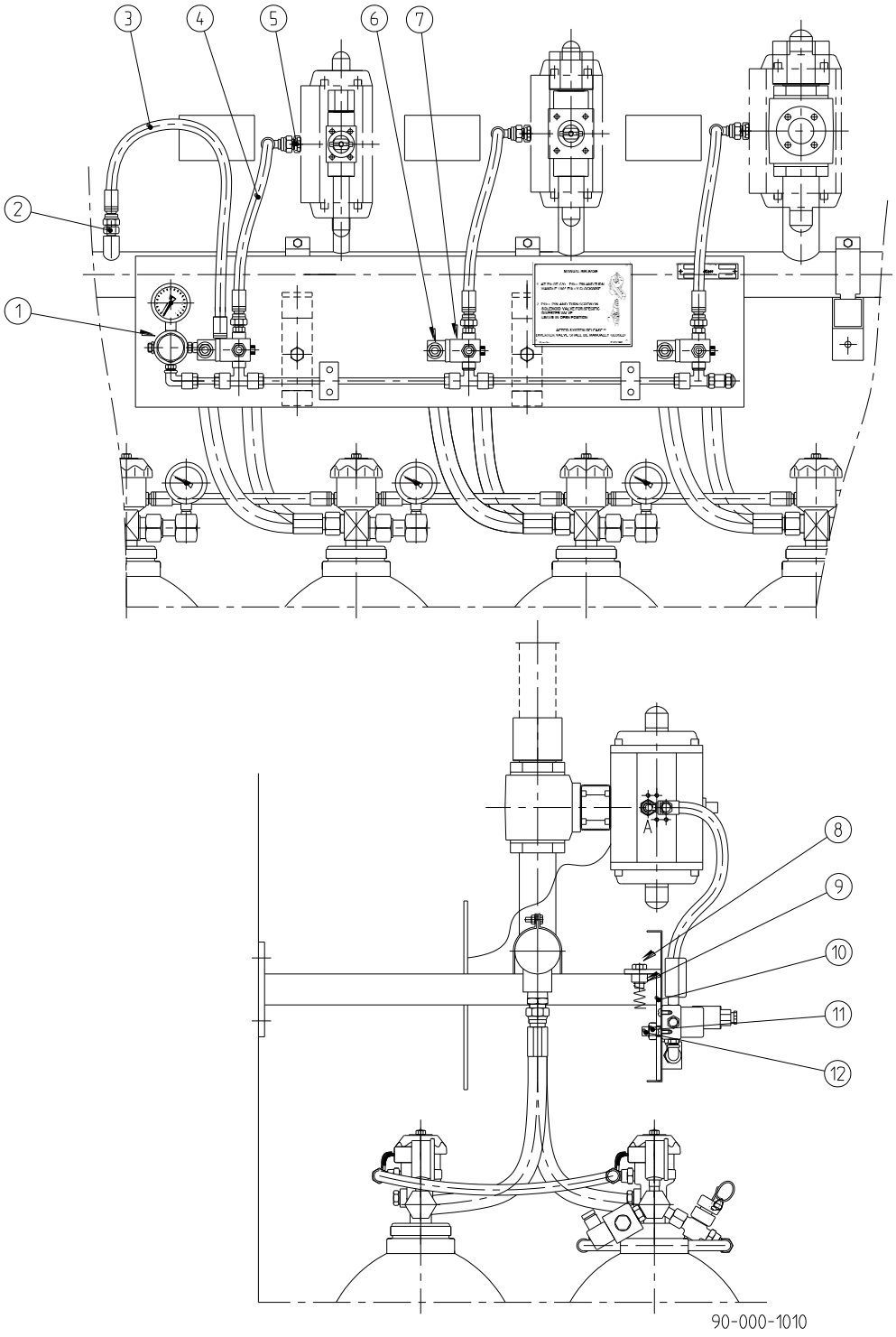
The inlet hose to the pressure regulator is to be connected to the outlet connection on the discharge manifold by use of the Hi-flex hose provided.

Once installation is complete, ensure that all 3/2 way solenoid valves have their manual over-rides in the closed position (i.e. cutter pin inserted with handle in closed position).

Key:
Detailed layout of Pilot Manifold Assembly (see sketch below)

1. Pressure reducing valve
2. Connection for ¼" Hi-flex hose, hose to be connected to nipple on site (A/F 19mm)
3. Supply hose from manifold, ¼" Hi-flex to pressure reducing valve
4. Supply hose from 3/2-way solenoid valve to actuator on diverter valve (to be connected on site, A/F 19mm)
5. Nipple on actuator (on diverter valve)
6. Coil on 3/2-way solenoid valve (cable 2 x 1.5□ to be terminated at site)
7. 3/2 way solenoid valves with manual over-ride
8. 12mm bolt for mounting to manifold bracket
9. Bracket for support of pilot arrangement
10. 12mm bolt for mounting of pilot arrangement
11. 12mm nut

14.7.1 **Pilot Manifold Assembly, Typical**



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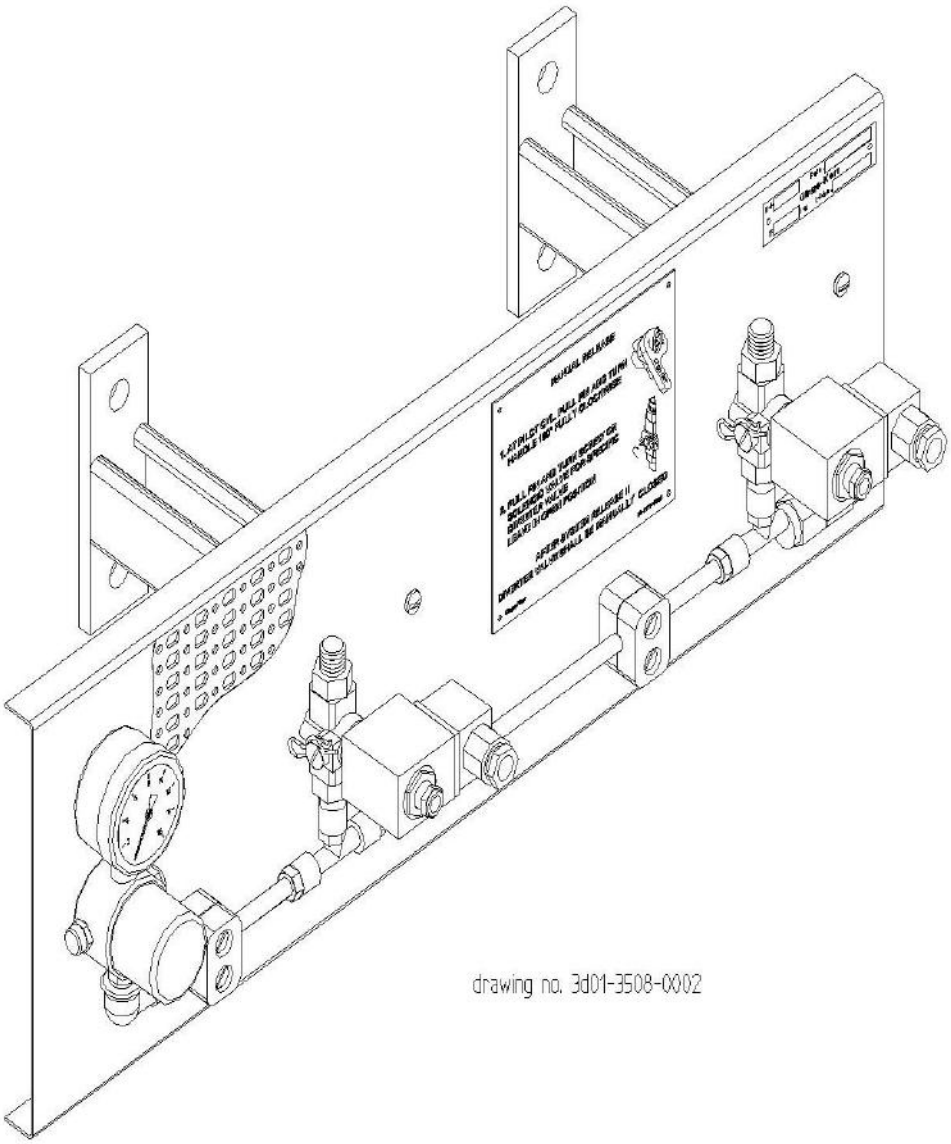
14.7.2 **Pilot Manifold, Typical Angled View**



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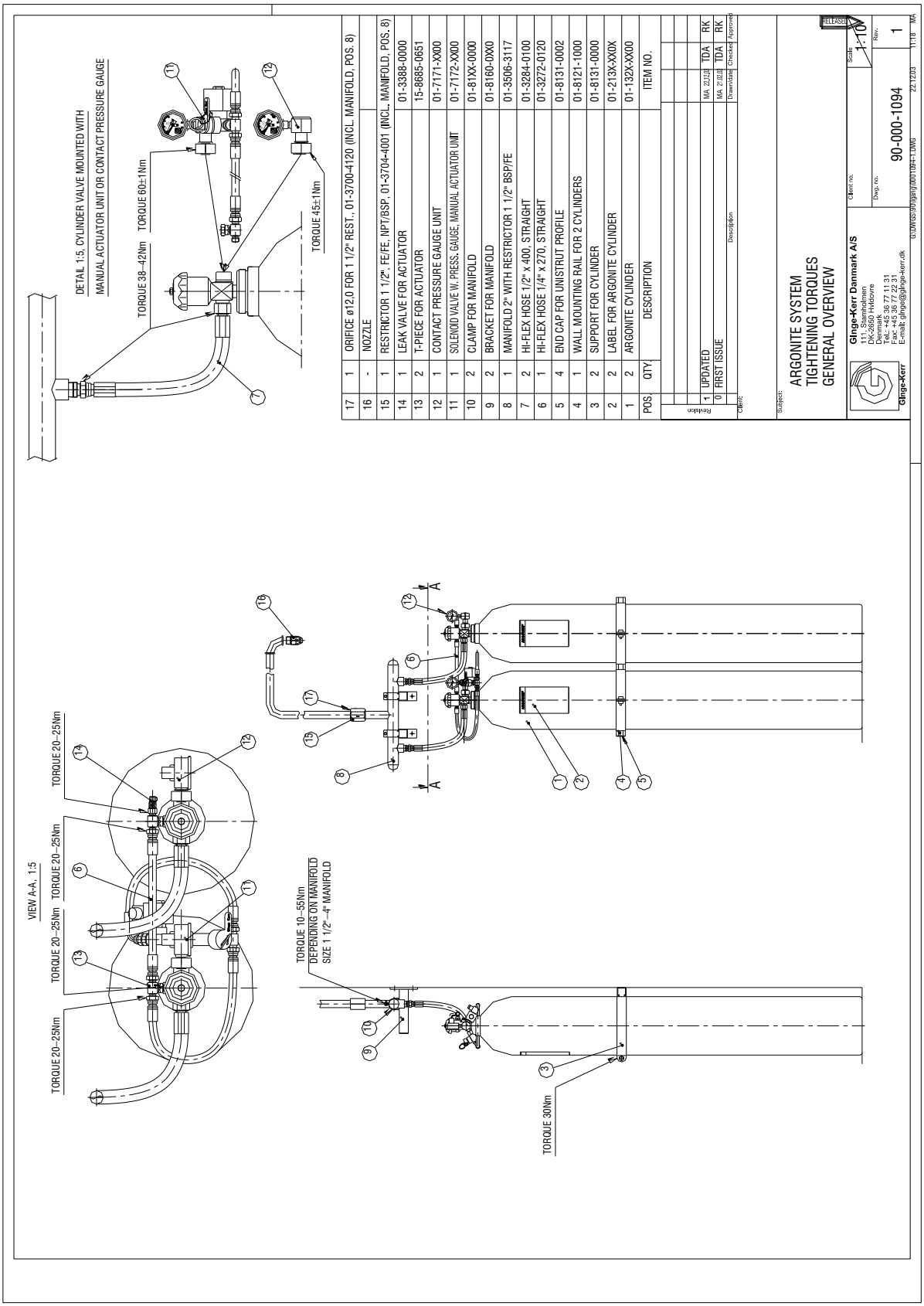
15 Overview, Torque Settings Cylinder assembly



POS.	QTY.	DESCRIPTION	ITEM NO.
17	1	ORIFICE ø12,0 FOR 1 1/2" REST., 01-3700-4120 (INCL. MANIFOLD, POS. 8)	
16	-	NOZZLE	
15	1	RESTRICTOR 1 1/2", FE/FE, NPT/BSP, 01-3704-4001 (INCL. MANIFOLD, POS. 8)	
14	1	LEAK VALVE FOR ACTUATOR	01-3388-0000
13	2	T-PIECE FOR ACTUATOR	15-8685-0651
12	1	CONTACT PRESSURE GAUGE UNIT	01-7171-XX00
11	1	SOLENOID VALVE W. PRESS. GAUGE, MANUAL ACTUATOR UNIT	01-7172-XX00
10	2	CLAMP FOR MANIFOLD	01-81XX-0000
9	2	BRACKET FOR MANIFOLD	01-8160-0X00
8	1	MANIFOLD 2" WITH RESTRICTOR 1 1/2" BSP/FE	01-3506-3117
7	2	HI-FLEX HOSE 1/2" x 400, STRAIGHT	01-3284-0100
6	1	HI-FLEX HOSE 1/4" x 270, STRAIGHT	01-3272-0120
5	4	END CAP FOR UNISTRUT PROFILE	01-8131-0002
4	1	WALL MOUNTING RAIL FOR 2 CYLINDERS	01-8121-1000
3	2	SUPPORT FOR CYLINDER	01-8131-0000
2	2	LABEL FOR ARGONITE CYLINDER	01-213X-XX0X
1	2	ARGONITE CYLINDER	01-132X-XX00

Rev.	Description	Drawn/date	Checked	Approved
1	UPDATED	MA 22.12.03	TDA	RK
0	FIRST ISSUE	MA 7.10.03	TDA	RK

16 Distribution Pipe & Fittings, Downstream Restrictor

Piping should be installed in accordance with good commercial practice. Care should be taken to avoid the potential for restrictions being caused by foreign material, faulty fabrication or improper installation.

The piping system should be securely supported with due allowance made for agent thrust forces and thermal expansion/contraction, and it should not be subjected to mechanical, chemical, vibrational or other damage (for the maximum recommended distances between supports, see Section 11).

Where there is an explosion risk, the piping should be attached to those supports which have been identified as being the least likely to be dislodged.

Open ended pipe sections, diverter valves, nozzle ports etc. should be protected against ingress of impurities until the installation is completed.

Although Inert Gas piping systems are not subjected to continuous pressurisation, provision shall be made to ensure that the type of pipe installed can withstand the maximum stress at the maximum storage temperature at the site.

The specifications listed below are to be considered as the minimum requirement for distribution pipe schedules used downstream of the restrictor (i.e. max. operating pressure of 60 bar).

The selected pipe schedule/quality downstream of the restrictor shall always be in accordance with the project specification accepted by the authorities having jurisdiction as well as the project specification.

Pipes to be laid in such a manner that accumulation of water within the pipe or pipe section is avoided slope towards nozzles. In cases where this isn’t possible the pipe sections to be provided with drain facilities.

16.1 Penetration of Building Structure

Penetration of structural elements shall be performed in an acceptable manner.

Appropriate insulation/sealing between the pipe penetrating and the building element shall be considered. Sealing material should have a fire resistance in accordance with the structural element being penetrated and, if the penetration is through an outer wall, an equivalent insolating property.

The penetration on both sides of the building element should be provided with an escutcheon plate selected in accordance with the existing architecture.

Penetrations through ceiling tiles shall take into account movement of the pipe during a discharge.

Reference is made to the project installation drawings.

17 Support of Pipes/Manifolds

17.1 Pipe Spans

The distance between supports should not exceed the distances stated in table 1 below.

Piping shall be securely anchored using solid supports, taking into consideration thrust forces and thermal expansion and contraction. It should not be subjected to mechanical, chemical or vibrational damage (or other harmful effects) unless specific precautions are taken.

Supports shall be fastened to an adequate structural member by the use of suitable anchors, expansion anchors, plugs or similar means. Anchors and fastening bolts shall be selected in accordance with the anticipated loads and the dimension of the hole in the relevant bracket.

N.D. (mm)	Max. Span (m)	Max. Free End (m)
15	1.5	0.8
20	1.8	0.9
25	2.1	1.1
32	2.4	1.2
40	2.7	1.3
50	3.4	1.7
65	3.5	1.8
80	3.7	1.9
100	4.3	2.0
125	4.8	2.0
150	5.4	2.0

Table 1, Pipe spans

17.2 Nozzle Supports

Adequate support shall be provided for nozzles and their reactive forces; in no case shall the distance from last support be greater than as follows:

a) Nominal pipe diameter ≤ ø25mm Max. ≤ 100mm
b) Nominal pipe diameter > ø25mm Max. ≤ 250mm

See also typical nozzle installation in cabinets, Chpt. 21.1

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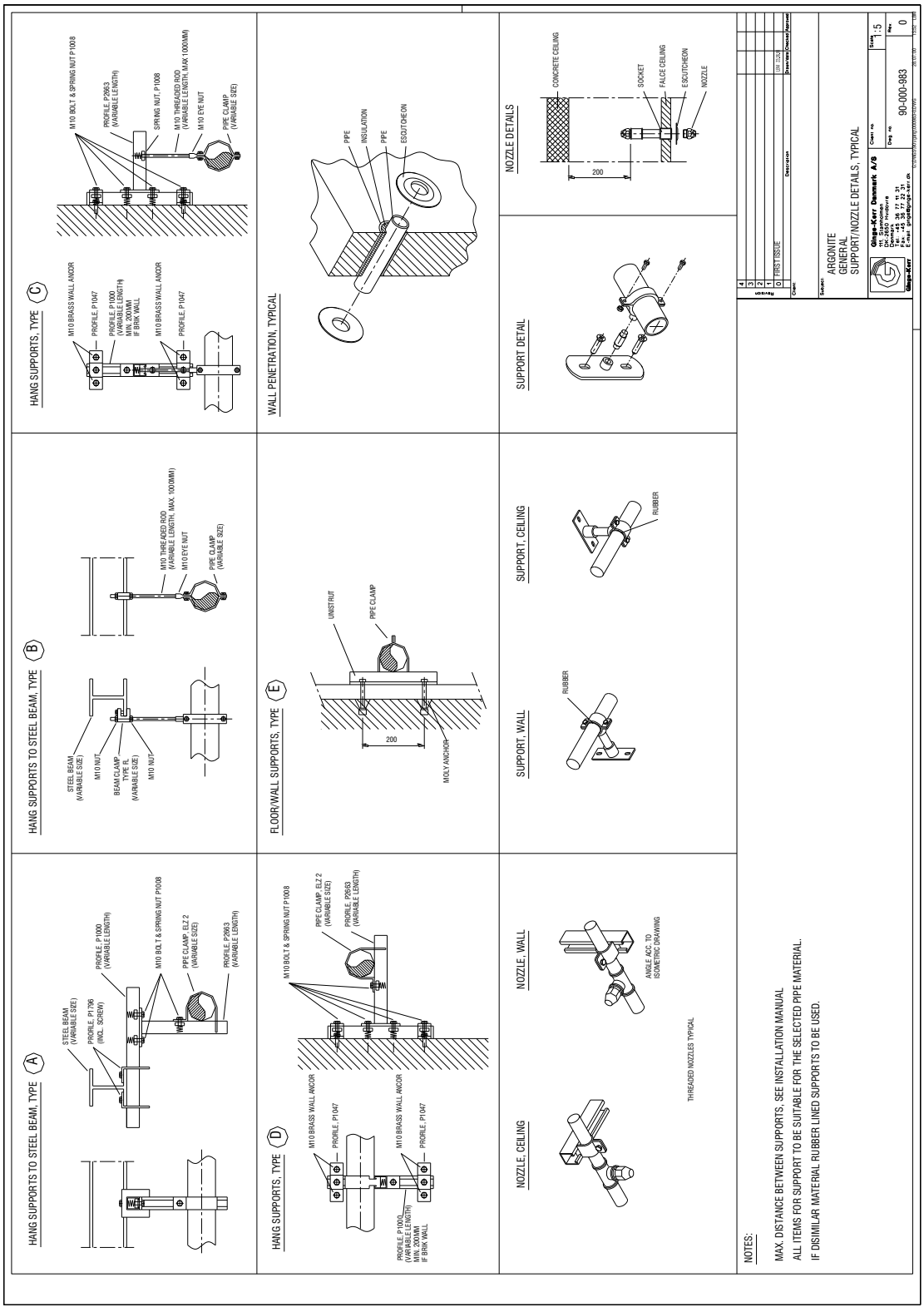
17.3 Support Details



18 Installation of Pipes

18.1 Cutting

The required length of pipe is measured and marked on the pipe. The pipe is cut at 90^{o} with a hacksaw or cutting machine.
After cutting, the pipe end shall be reamed and all burrs removed.

18.2 NPT/BSPT – Threading

Threads shall be cut to the full cutting length as specified below using a pipe-threading machine.

Pipe Diameter	Length of NPT-Thread	Effective Length of NPT-Thread	Free Length of NPT-thread.
1/2"	14.50 mm	13.56 mm	0,94 mm
3/4"	16.00 mm	13.86 mm	2,14 mm
1"	19.00 mm	17.34 mm	1,66 mm
1 1/4"	20.50 mm	17.95 mm	2,55 mm
1 1/2"	20.50 mm	18.38 mm	2,12 mm
2"	22.00 mm	19.20 mm	2,80 mm
2 1/2"	31.00 mm	29.00 mm	3,00 mm
3"	33.50 mm	30.48 mm	3,02 mm

Table 2 - NPT Thread

Pipe Diameter	Length of BSPT-Thread (mm)	Effective Length of BSPT-Thread (mm)	Free Length of BSPT-thread.
1/2"	14.50	13.0	1,50 mm
3/4"	16.00	15.0	1,00 mm
1"	19.00	17.0	2,00 mm
1 1/4"	20.50	19.0	1,50 mm
1 1/2"	20.50	19.0	1,50 mm
2"	22.00	20.0	2,00 mm
2 1/2"	31.00	27.0	4,00 mm
3"	33.50	30.0	3,50 mm

Table 3 - BSPT Thread

After the thread has been cut it is recommended that the crest and root of the thread is truncated (shortened) a minimum of 0.033 x p (pitch of thread) in order to ease adherence of the packing material.

Note: When assembling NPT threads a distance between the two parts will always be visible (refer to table above).
After threading, the pipe shall be cleaned to remove excess cutting oil and any other foreign objects.

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18.3 Grooved joining

Two types of grooved joining exist; cutting and rolled groove.

When preparing either type of groove, the manufacturer's instructions shall be followed and only tools recommended by the manufacturer shall be used.

When cutting grooves it shall be verified that the resultant wall thickness (bottom of the groove) meets the requirement for the specified minimum pipe wall thickness (i.e. the pipe schedule used when cutting grooves will need to be higher than the normal sch.40).

The Cut groove method shall only be used if accepted by the project engineer and the authorities having jurisdiction.

18.4 Installation of Pipes

Threaded fittings and pipe up to ND 80 shall have either NPT or BSP threads, or as required by the fittings used.

Pipe ends shall be reamed after cutting to remove all burrs and all cutting oil shall be removed from both inside and outside of the pipe.

Joint compound, liquid sealant or tape shall be applied to the thread of the male pipe/fitting end and not in the fitting.
Joint compound, liquid sealant or tape shall not be applied on the first two to three pitches of the thread.

The joint compound, liquid sealant or tape used shall be able to withstand the temperature expected in the vicinity of the pipes.

Care shall be taken that the pipe ends extend into fittings sufficiently.

The size of pipes installed must be strictly as indicated on the piping plan and the piping isometric for the system.

The pipes shall be supported at no greater than the maximum distances shown in Section 6, table 1.

Pipe runs shall unless otherwise specified be horizontal/vertical.

Pipes however in areas where condensation may be expected however to be laid (sloped) in such a manner that avoidance of accumulation of water within the pipe or pipe section is prevented. In cases where this isn't possible the pipe sections to be provided with drain facilities.

Note: Should site conditions demand major alterations to the pipe layout, notification shall be given to the design engineer on a marked up copy of the relevant drawings for updating and preparation of new 'as-built' flow calculations. These will evaluate the new pipe runs and determine whether modifications to the design are needed.
The design engineer shall approve the new pipe run before installing of the pipes.

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18.6 Threaded pipe assemblies'

There is no standardized method of tightening an NPT thread (tapered pipe thread). The best practice is to follow the standards for the industry. What follows is a rather lengthy discussion of problems that might encounter using all of the commonly used methods. This may help solve a problem ifn your "industry standard method" fails.

Pipe thread fittings seal using a metal-to-metal connection.
The metal of the male and female fittings deforms during installation to create this seal. As a result, pipe thread connections tend to leak after a connection is made and then disassembled and re-assembled. If the connection leaks after re-assembly, you may need to replace one or more of the fittings. Continuing to tighten the connection will not necessarily eliminate the leak and can easily result in a split fitting or port.
Over-tightening the connection can easily split the female portion of a pipe thread connection; this is especially an issue when installing male pipe thread fittings into cast iron ports on valves, motors, and cylinders. Split ports are not covered by Kidde' / manufacturers' warranties!

STEP 1:
Inspect port and fitting to ensure that both are free of contaminants and excessive burrs and nicks. *(Always cut and check on a scrap piece of pipe first, this should be done when changing diameter of pipe and after every 10 pieces of pipe have been cut and threaded)*

STEP 2:
Apply a stripe of an anaerobic liquid pipe sealant around the male threads leaving the first two threads uncovered. If no liquid sealant is available, wrap Teflon tape 1-1/2 turns in a clockwise direction,
viewed from the pipe end, leaving the first two threads uncovered.

Warning: ***Teflon tape and some pipe sealants are destructive to hydraulic components. Always use extreme caution and follow manufacturer's recommendations for proper application of any sealant in order to prevent contamination.***

STEP 3:
Screw finger tight into the port.

STEP 4:
Wrench tighten the fitting to the correct Turns Past Finger Tight position (See following table).
When installing elbows or tees, consider final orientation position as to not exceed the recommended TPFT.
A properly assembled fittings total thread engagement should be 3.5 to 6 turns.

Warning: ***Never back of an installed pipe fitting to achieve proper alignment. Loosening installed pipe fittings will corrupt the seal and contribute to leakage and failure.***

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Fitting Size	Dash Size	Turns Past Finger Tight	Torque ft/lbs
⅛″ NPT	-02	1.5 - 3.0	12
¼″ NPT	-04	1.5 - 3.0	25
⅜″ NPT	-06	1.5 - 3.0	40
½″ NPT	-08	1.5 - 3.0	54
¾″ NPT	-12	1.5 - 3.0	78
1″ NPT	-16	1 - 2.5	112
1¼″ NPT	-20	1 - 2.5	154
1½″ NPT	-24	1 - 2.5	211
2″ NPT	-32	1 - 2.5	300

Warning: **Should liquid sealant 'Loctite' or similar be used at any moving parts such as diverter valves it shall only be used with extreme caution. Liquid sealant must never be allowed to enter any moving parts such as ball valves.**

18.6.1 **TOURQUE:**

Torque installation of pipe fittings is not a recommended practice. Thread taper and quality, different port and fitting materials, plating thickness and types, varying thread sealants, orientation, and other factors reduce the reliability of a torqued connection. If torque installation is required, refer to the above table for suggested torque values. Some industries may desire a torque value. This works fine until you use a tapered fittings such as NPT fitting that is out of spec and bottoms out in the boss before reaching torque; Or the fitting that still leaks even though you have applied the proper torque; Or the specified torque is reached and the fitting is pointing in the wrong direction. Torque is not always practical with NPT or other tapered fittings because of the wide differences in friction (material, pipe dope, Teflon tape). Torque will sometimes get you in trouble; understand its weakness and use other quality assurance methods along with torque.

18.6.2 **FEEL:**

Most screwed piping is tightened until it feels "right" and the fitting is pointing in the desired direction. What the experienced mechanic is often "feeling" is how the fitting is getting tight. Screw it into until it starts to seat. Then up the force a little by yanking. If each yank gives less movement, you probably have a sound joint. If the movement stops suddenly, you have probably bottomed out. The experienced plumber knows when to stop before he damages the fitting or boss. Caution is advised, as tapered fittings applied too excessive torque may crack the recipient. This is especially true when using Teflon tape because the low friction of Teflon makes it easy to over-tighten.

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18.6.3 NUMBER OF ROTATIONS:

Included in the standards for NPT threads are engagement length, both straight and wrenched. For example, a 1/4" tapered pipe fitting should screw in 4.1 threads until finger tight (hand tight engagement), and 3 threads for wrench makeup. One problem is the wide variance in quality of the fittings and threads. Few ¼" fittings screw in 4.1 threads before they reach finger tight. As a general guideline, after hand-tight engagement, tighten 2-3 full turns for sizes up to 1 inch for NPT thread fittings. You should have between 3.5 and 6 engaged threads. Any number outside of this range may indicate either under or over tightening of the joint or out of tolerance threads.

18.6.4 ASSEMBLY PROBLEMS:

Perhaps the most common fault is cross-threading the members and not realizing it. The male thread fitting needs to be aligned with the axis of the tapped hole. Rotation force should gradually increase with tightening.
Using a liquid thread sealant for NPT connections is recommended over using Teflon tape. If using Teflon tape, only use one-and-a-half wraps around the male portion of the thread. Start two threads up from the end of the male portion of the fitting.

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19 Repair

19.1 Galvanising

Damaged galvanising shall be repaired using cold "Galvafroid" (or similar) in accordance with the manufacturer's recommendations.

19.2 Painted cylinders

Damaged paint shall be repaired using procedures in accordance with the paint manufacturer's recommendations.
Colour codes, refer to specific data sheet

The factory coating is TIGER Aqualac, which is a water-soluble, high quality primer based on Alkyd-Epoxy-Melamine resins with superior corrosion protection and very good adhesion on steel. Free of lead, cadmium and chrome. (Requires no declaration acct. guidelines of the European community)

19.2.1 Pre-treatment

Grease, oil, rust and any other deposits/residues which may affect the finish to be removed from the damaged area
Grind area to bare metal
Clean area using deionised water
Dry area using clean cloth
Apply paint in the required RAL code by brush or roller
Drying time approx. 30 min at normal room temperature
Cleaning of equipment, spills etc: clean with tap water immediately after usage

19.2.2 Actuator on diverter valve

Never attempt to modify the actuator assembly (i.e. never open the actuator).
Only specialists with the required skills shall perform any repair work.
Should the unit fail to operate as intended contact Kidde Products Ltd.

20 Welding of pipe and fittings

Field welding may be permissible and should be used for pipe sizes with a diameter larger than ND 80.

Safe welding and cutting practices shall be followed.

Always perform hot work in well ventilated areas or have proper ventilation arrangements for removal of fumes.

Always have a portable fire extinguisher within reach.

Welding methods which comply with local requirements shall be followed:

Example:
Requirements of American Welding Society AWS D10.9, Standard for Qualifications of Welding Procedures and Welders for piping and Tubing, Level AR-3, are acceptable means of joining fixed piping.

Welding procedures, welders and welding machine operators shall be qualified in accordance with local requirements.

Welded fittings and welded formations manufactured, fabricated, or joined in conformance with a qualified welding procedure as set forth herein are acceptable under this standard, provided that materials and wall thicknesses are comparable with other sections of this standard.

No welding shall be performed if there is impingement of rain, snow, sleet or high wind on the weld area of the pipe product.

When welded outlets are formed:
(a) Holes in piping shall be cut to full inside diameter or shaped contoured nipple
(b) Discs shall be retrieved
(c) Openings in piping shall be smooth
(d) All slag and other welding residue shall be removed
(e) Fittings or shaped, contoured nipples of any length shall not penetrate beyond the internal diameter of the piping

When reducing a pipe size in the run of a main, cross main, or branch, a suitable reducing fitting designed for that purpose should be used.
Welded parts shall be galvanised or suitably coated after welding.

20.1 Qualifications

1. A welding procedure shall be prepared and qualified before any welding is done. Qualifications of the welding procedure to be used and performance of welders and welding operators are required and shall comply with the requirement of AWS D10.9. Standard for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3 (or local requirements).

2. The contractor shall be responsible for all welding installed by personnel of his organisation.

3. The contractor shall be responsible for qualifying any welding procedure used by personnel of his organisation.

4. The contractor shall be responsible for qualifying all the welders and welding machine operators the contractor employs in compliance with the requirement of AWS D10.9.

5. Standard for Qualifications of Welding Procedures and Welders for piping and Tubing (or local requirements).

6. Qualifications Records.

The contractor shall maintain certified records, which are available to the authority having jurisdiction, of the procedures used and the welders or welding machine operators employed by the contractor.

Records shall show the date and the results of procedures and performance qualifications.

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21 Nozzle installation

An Inert Gas discharge nozzle (see below) consists of a nozzle body (2); a project specific orifice plate (1) and an orifice securing ring (3).

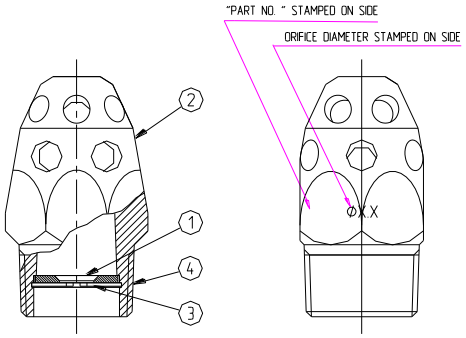
Nozzles have a male taper thread; (NPT or BSPT) (4) or as specified in the project documentation.

The orifice diameter is stamped on the hexagon of the nozzle.

Nozzles shall be installed strictly in accordance with the piping layout and the piping isometric.

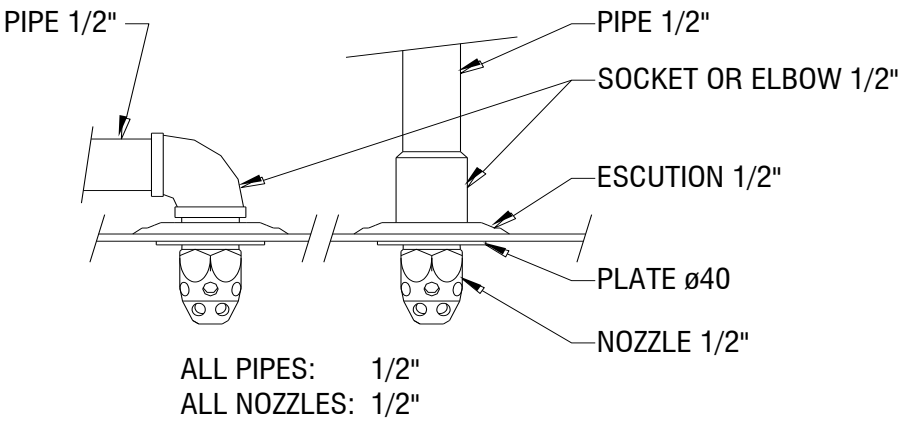
Location and size of the nozzle(s) are indicated on the piping plan and or piping isometric(s).

Care shall be taken that the Nozzles are complete (orifice plate inserted and secured) and that no damage to the thread has occurred.



21.1 Typical installation, cabinets

TYPICAL NOZZLE INSTALLATION, CABINET



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22 Flushing of Pipework

After installation of the distribution pipe work it is recommended that the pipework be flushed in order to remove debris, impurities, remnants of sealing material, cutting burrs, etc. as well as to verify that flow is continuous and that the piping is unobstructed.

It is recommended that a flow rate of ~6m/sec is achieved during flushing.

Flushing shall be completed prior to installation of the discharge nozzles and preferably before the cylinder bank assembly.

Recommended media are water or compressed air or an Inert Gas.
If a gaseous medium is used it must be ensured that the pipe work has not been sealed in any way.
Recommended pressure is 20bar, which may require the distribution pipework to be flushed in sections.
For marine installations a minimum pressure of 20bar shall always be used.

Note: Test report/statement of completion must be issued
See Test Report sample, shown below.
It is recommended that the calibrated flow meter used is listed on the test report.

23 Pressure Testing of Pipework

Once installation of the open ended pipe work is complete, all nozzle connections shall be plugged.

1) Disconnect the pipe upstream of the restrictor and fit the distribution pipe inlet with a test valve which incorporates a hose connection to the pressure testing equipment ***(union/flanged connection to be supplied locally).***

It shall be ensured that water does not enter the cylinder valves or remains in the manifold arrangement after the pressure testing.
Piping shall then be blown through with compressed air or Inert Gas until all moisture has been removed.

It is recommended that the pressure testing is performed prior to the cylinder bank assembly.

2) If no union/flanged connection has been installed one of the manifold check valve connections may be used.

Disconnect all discharge hoses from the manifold.
Connect the pressure testing equipment to the check valve (½" BSP).

It shall be ensured that water does not enter diverter valves, cylinder valves and that no water/moisture remains in the manifold arrangement after the pressure testing.

-

Piping shall be blown through with compressed air or Inert Gas until all moisture has been removed.

23.1 Pressure Testing Using Water

The pipework shall be pressure tested to the requirements of the authorities having jurisdiction and/or as stated in the system documentation. It is recommended that water is used as the pressurising media however in some circumstances that may not be allowed and a gas may have to be used.

Before carrying out the pressure test:

1. Insure that no water can enter the diverter valve arrangement if installed,
2. Verification documents for the pipes and fittings used shall be present
3. The installation has been visually inspected and found to be in good order

It is recommended that the pressure applied during the test is 1.5 times the maximum operating pressure (normally 60 bar, test pressure equal to approx. 90 bar).
Lloyds specifies a minimum test pressure of 125 bar.

Recommended holding time is 10 minutes to ensure that both the pipe and fittings used and the overall assembly will withstand the operating pressure as well the "water hammer" effect which occurs at the start of the discharge.
(A pressure drop of more than 5 bar shall not be accepted).

If the required pressure cannot be maintained for the minimum hold time, all connections shall be checked for leakage. Any connection found to be leaking shall be tightened and the procedure is repeated until a successful test has been completed.

It shall be ensured that water does not enter the cylinder valves or remains in the manifold arrangement after the pressure testing.
Piping shall be blown through with compressed air or an Inert Gas until all moisture has been removed.

23.2 Pressure Testing Using Gas

1. Disconnect the pipe upstream of the restrictor and fit the distribution pipe inlet with a test valve which incorporates a hose connection to the pressure testing equipment ***(union/flanged connection to be supplied locally).***

2. If no union/flanged connection has been installed one of the nozzle connection points or a manifold check valve (½" BSP connection) may be used.

-

23.2.1 Precautions

Pneumatic testing involves the hazard of energy stored in compressed gas.

Particular care must therefore be taken to minimise the chance of failure of brittle components during a pneumatic test.

In areas where water cannot be accepted as the media for pressure testing (i.e. operating computer rooms etc) compressed air/ Inert Gas may be used. All due precautions shall be taken to prevent injury to personnel while the pipes are under pressure (i.e. always maintaining a safe distance from the pipe work and a total evacuation of all areas affected shall have been ensured both prior to and during the pressure test.

The pressure test shall be performed from outside the room containing the pipe work. Compressed air/ Inert Gas pressure must be applied slowly through a pressure regulator. When a pressure of approx. 2 bar is attained, a preliminary check shall be made, including examination of joints/fittings etc. After the inspection (if all joints/fittings etc. are found to be tight) the pressure shall be gradually increased in steps 15 bar, 30 bar, 45 bar, 60 bar, 75 to finally 90, the pressure at each step to be held long enough to equalise piping strains.

The final test pressure shall be maintained for 10 min.
A pressure drop of more than 5 bar shall not be accepted.

Whilst the pipework is pressurised it shall be ensured that all entry into the room is prevented until after the pressure has been relieved from the installation.

Local requirements may not allow for the use of compressed air/ Inert Gas as the pressurising media. Approval from local authorities must be obtained in each case.

23.2.2 After Pressure Testing

The internal pipework shall be dried out. This may be achieved by using compressed air, nitrogen or a similar gas. No moisture shall be left in manifolds or distribution pipework, neither should there be any moisture left in diverter valves when installed.

Note: Test report/statement of completion must be issued
Sample, Test Report
It is recommended that the calibrated flow meter used is listed on the test report.

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Kidde Inert Gas Test Report
Piping Installation

Client: * Date:
Client's Order No.: *
File No.: *
Installer: *
Equipment no.: Flow meter/Gauge/Transducer: …….
- -
System: *
Isometric. no.:

Flushing	Date	Amount	
Duration	.. / .. / ..	..... dm^3/min	..... min.
Pressure test	Date	Pressure	
Duration	.. / .. / ..	..... bar	..... hour
Leakage test	Date	Leakage	Duration
	.. / .. / ..	..... dm^3	..... hour

Drying out pipe work: Date:

Remarks:
.....

.....

.....

.....

Witnessed/Approved by:

For: Client	For: Installer	For:
Name:	Name:	Name:
Signature	Signature	Signature

-

24 Signs and Labelling

24.1 Storage room

All doors to the system storage room shall be marked with a sign with the following text (in the local language): (ref. 01-2200-0002)
Storage Room for: Inert Gas Cylinders

During installation of the high pressure cylinders, access doors to be provided with a sign

"No Entry !!! High pressure cylinders installation in progress"

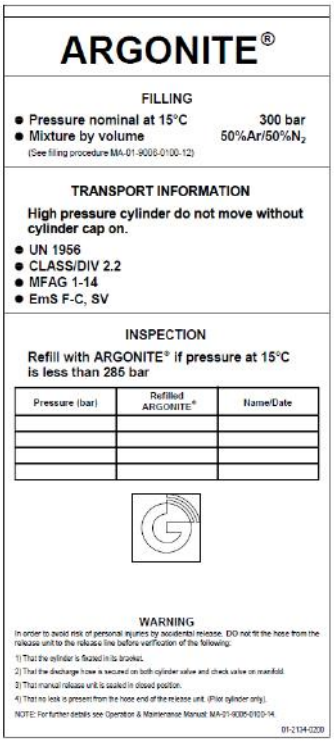
24.2 Cylinder

Each cylinder shall be labelled with an Inert Gas service label after completed installation
(ref. 01-2131-0xxx).

Labels shall be attached on the front of the cylinders and at same height.

The purpose of the label is to provide filling information, transport/safety information, inspection information and general precautions to be taken during reinstallation of the cylinder.

24.2.1 Typical Cylinder Label



24.2.2 Diverter Valves

Each diverter valve shall be provided with a sign/label indicating the area that is protected by that valve.

In a convenient place on the Pilot/Diverter manifold a sign giving instructions for how to close the valves after a release should be fixed.

24.3 Protected Enclosure

24.3.1 Access doors, exterior face

All access doors to the enclosure shall be provided with a warning sign with the following text (in the local language) (ref. 01-2173-0x00).

This room is protected by an Inert Gas System and shall be left at once when alarm sounds

24.3.2 Escape/access doors, interior face

All escape/access doors from the enclosure shall be provided with a warning sign with the following text (in the local language) (ref. 01-2174-0x00).

Inert Gas alarm, When alarm sounds – leave at once! Inert Gas being released

It is recommended that doors acting as escape routes are provided with an escape sign (ref. 15-4540-0004) (green background, white icon).

24.3.3 Warning Alarms

Audible and visual alarm devices shall be provided both within and outside of the enclosure, displaying a warning sign with the following text (in the local language) (ref. 01-2174-0x00)

Inert Gas alarm, When alarm sounds – leave at once! Inert Gas being released

24.3.4 Pressure Relief Vents

Relief vents/openings shall display a warning sign with the following text (in the local language) (ref. 01-2172-0x00)

Vent for Inert Gas, keep clear

24.3.5 Relief of excess gas

Nozzle installed for relieving excess gas outside the protected enclosure shall display a warning sign with the following text (in the local language) (ref. 01-2172-0x00)

Vent for Inert Gas, keep clear

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25 Electrical Installation

The cable routing plan shall include all electrical components including detailed loop information and the cable quality to be used, such as; mm sq, rating IEC, braiding, twisted cores, required material and colour of the outer sheath, bending radius, max. distance between supports/strapping, 90º crossing etc.

Also the cable routing plan shall include notes regarding maximum distances allowed for parallel runs, minimum distances between control and power cables (normally 500 mm), and separate cable ways/trays to be used etc.

25.1 Solenoid valve, release and selection

In order to avoid accidental release of the system, it is recommended that the coils only to be attached to the solenoid valve until after the control panel has been finally commissioned and found to operate as intended.

Note: Never attempt to relocate the solenoid valve from its mechanical position; twisting / turning will cause the seal to break and result in a leak.

Cable(s) between the control panel and the cylinder battery should, as a minimum, be one pair cable 1.0 sq. in accordance with IEC 331/332 or in accordance with the requirements for the control installation.

Max. cable length 75m in order to limit power loss, max. 5% power from the panel to the coil.

For some installations also an earth core may be required.

Braided core shall be fitted with a cable "tube" before termination.

Once the cores have been inserted and terminated in the female connector part, tighten the gland lightly by hand until there is sufficient resistance to the cable being pulled out.
Attach the female connector part to the male connector part on the coil and secure in position by tightening the locking screw.
No adjustment to the position of the connector shall be accepted as twisting will lead to internal disconnection from the coil.

It is recommended that each cable/core between the release and control panel and the cylinder battery has a cable identification no. in accordance with the wiring diagram or otherwise agreed.

It is recommended that each core has an identification no. corresponding to the terminal no. into which it is terminated.

Minimum recommended bending radius for 0.5 sq. single pair cable: 80 mm (should always be verified against the manufacturer recommendations).

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Cables should be secured to cable trays (or an alternative solid construction element) with cable strips or other suitable means (according to normal practice)

Junction boxes supplied by others recommended having terminals suitable for up to 2.5 sq. mm.

Junction boxes should be provided with an identification tag number (number to be in accordance with the system-wiring diagram or as otherwise agreed).

25.2 Pressure Gauge/Switch Unit(s)

Connect the contact gauges/switch as indicated on the electrical wiring diagram and terminate in the allocated terminals in the control panel/junction box.

The contact gauges/switch should be connected in a single loop configuration (between cylinders) with the 0,5 sq. x 500 mm single core cable provided. The single core cable in/out of the female connector by use of the dual orifice gland seal or if a “pair” cable used the single orifice gland seal.

After inserting the single core cable ends into the female connector, tighten the gland lightly by hand until there is sufficient resistance to the cable being pulled out.
Once the cores have been inserted and terminated in the connector,

Attach the female connector part to the male connector part on the unit and secure in position by tightening the locking screw.
No adjustment to the position of the connector shall be accepted as twisting will lead to internal disconnection from the switching element.

Minimum recommended bending radius of single core cable: 40mm (should always be verified against the manufacturer’s recommendations).

Any junction boxes used should be provided with an identification tag number (number to be in accordance with the system-wiring diagram or as otherwise agreed).

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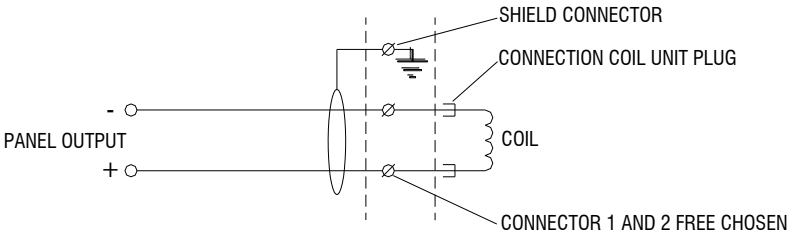
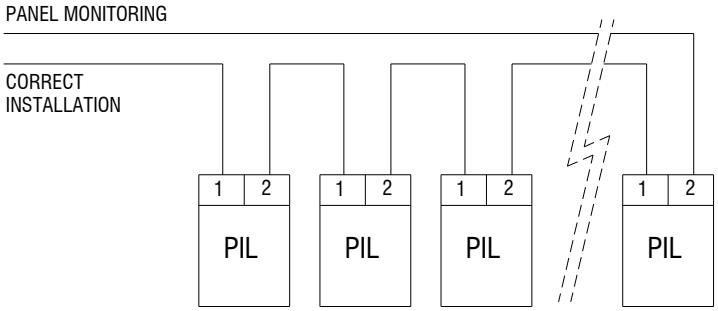
25.3 Typical Wiring Details

SOLENOID CONNECTION

24V DC SOLENOID CONNECTION TO NON REVERSIBLE VOLTAGE OUTPUTS:

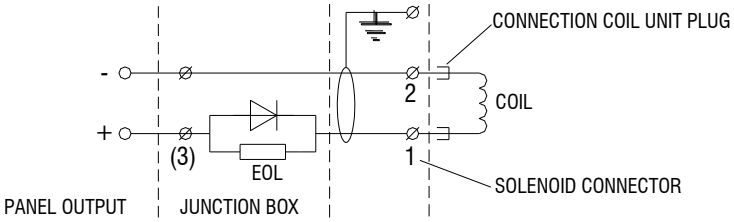


PRESSURE SWITCH CONNECTIONS 2 PIN (GAUGE CONTACT TYPE)



SWITCH OPENS ON LOW PRESSURE

24V DC SOLENOID CONNECTION TO REVERSIBLE VOLTAGE MONITORING OUTPUTS, GK TYPE 3010-1010



GK TYPE 1010: EOL = 6,8K ohm OR 8,2K ohm
GK TYPE 3010: EOL = 10K ohm
DIODE IN4007 OR SIMILAR
OTHER EOL VALUES POSSIBLE, REFER TO PANEL SPECIFICATIONS.
EOL AND DIODE TO BE POSITIONED CLOSE TO COIL.
IF A 4 PIN CONNECTOR IS AVAILABLE USE PIN 3.

90-000-1018

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26 Risk Assessment

Both prior to and during the installation of an Inert Gas system there are a number of aspects to consider in order to have a safe working place and to enable the safe handling of the equipment to be installed.

Below is listed a number of risks that have to be considered and addressed.

26.1 Possible Hazards

	Item	***Hazard***
A.	**Health and Safety**	
A.1	Cylinder Handling, no transport cap fitted, non secured cylinder	Cylinder can fall/tip, breaking off the valve personnel can get severely hurt
A.2	Improper cylinder trolley	Cylinder may "fall" off breaking off the valve, personnel can get severely hurt
A.3	Welding activities.	Fire can occur, welding can pollute the air
A.4	Dust from drilling	Breathing problems, dust in eyes
A.5	Sloppy operation with extension cores for electrical tools, lighting.	Fitter can stumble and get hurt
A.6	Messy area at cutting and threading.	Fitter can stumble and get hurt
A.7	Cylinder assembly used as scaffolding	Manifold can, break loose and damage the cylinder valves
A.8	Other mechanical work in progress during cylinder assembly	Scissor lift, fork lift truck can tumble the cylinders, breaking off the valve personnel can get severely hurt
B.	**Technical**	
B.1	Proper installation	Failure of installed equipment with possible replacement issues as a result
B.2	Damaging of installed equipment	Damages due to substandard workmanship or other activities after installation, necessitating replacement.
B.3	Welding	Welding not performed correctly resulting in need for difficult repair works
B.4	Equipment too heavy	Concrete floor will break/be damaged necessitating repair (civil works and/or equipment).
B.5	Equipment too large in size	Installation cannot be performed due to new design/equipment to be provided
B.6	Cores in cables to solenoid valves too small	Power supply to solenoid valves may be reduced to the point where it may be insufficient to open the valve.

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C.	Interfaces	
C.1	Access to area for installation of each system	Owner delayed with civil works causing delay to whole project time schedule
C.2	Technical interface with fire detection & control system	Extinguishing System does not have proper function due to lack of electrical input.
C.3	Materials not on Site before installation start	Installation cannot start as planned

26.2 Risk Rating

Item	Probability	Impact	Risk Rating
A.1	Low	High	Low
A.2	Medium	High	High
A.3	Medium	High	High
A.4	High	Low	Low
A.5	Medium	Medium	Low
A.6	Medium	Medium	Medium
A.7	Low	High	High
A.8	Low	High	High
B.1	Low	High	Low
B.2	Low	High	Low
B.3	Medium	Medium	Medium
B.4	Low	High	Low
B.5	High	High	Low
B.6	Low	High	Low
C.1	Medium	High	High
C.2	Low	Medium	High
C.3	Low	High	Low

26.3 Measures to reduce Risk

Item	Mitigating Action
A.1	Always keep cylinder cap on during transportation and until secure in brackets.
A.2	Always use proper transport trolley, up to a carrying weight of 300 kgs.
A.4	Procedures for hot work as well as removal of fumes etc. to be followed
A.5	Lay cables etc. in locations outside working/walking areas.
A.6	Clean up room
A.7	Fit signage prohibiting use as scaffolding
A.8	Prohibit any other work in the storage room, fence off cylinders or the like
B.3	Procedures for random spot check, Non-destructive Testing (NDT) to be implemented
B.6	Procedures for random spot check, Electrical commissioning checklist
C.1	Careful planning, continuous follow-up on Site and implementation of Site meetings
C.2	Careful design and design specifically carried out in order to prevent the situation.

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27 CE marking acct. Pressure Directive, PED:

All pressure equipment covered by EU Directive EC, 97/23 installed within Europe shall be marked with the "CE" followed by the number of the authority who has verified the installer's QA system.

The CE marking clearly defining the boundary of the installation shall be prominently displayed.

The accompanying documentation for the installation shall be supplied to the user/owner of the system (manufacturing record book)

27.1 Distribution Piping Downstream of the Restrictor

If the pipe system downstream of the restrictor consists entirely of pipe diameters up to and including 1/1/4", it shall ***not*** be CE marked.

If the pipe system downstream of the restrictor includes pipe diameters of between 1½" and 4", it shall be CE marked in accordance with Category I Module A (*see implications below)*

The local notified body shall always be in agreement with the actual steps performed.

28 Discharge Hose for VdS

28.1.1 For VdS System Compliance Use discharge Hose 01-3284-5xxx0

sales@norrscope.com

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