MANUAL

INSTRUMENT AIR LINES

DEP 32.37.51.11-Gen.

July 1985
(DEP Circular 48/99 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

USED BY

COMPANIES OF THE ROYAL DUTCH/SHELL GROUP

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
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The Hague, The Netherlands,

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They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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1) Operating companies having a Service Agreement with SIOP, SIEP, SIC or other Service Company. The use of DEPs by these Operating companies is subject in all respects to the terms and conditions of the relevant Service Agreement.

2) Other parties who are authorized to use DEPs subject to appropriate contractual arrangements.

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All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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APPENDICES

1. INTRODUCTION

1.1 GENERAL

This new publication, specifies the minimum requirements for pneumatic signal lines and for the connection of instrument air supply lines to an air supply header provided by mechanical engineering, it also gives guidance on how these requirements can be met.

The subject of this manual previously formed a part of DEP 32.37.50.11-Gen., dated April 1976, which has been superseded by DEP 31.37.00.11-Gen., 'Instrument Air Supply'

It is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration, production and new ventures.

In accordance with the requirements of this manual, instrument air supply piping smaller than DN 50 should be restricted to an absolute minimum. The DN 15 linepipe, elbows, tees, nipples and unions of the previous publication have been replaced by metric sized tubing and compression fittings.

Unless otherwise authorised by SIPM, the distribution of this manual is confined to companies belonging to or managed by the Royal Dutch/Shell Group, and to contractors nominated by them.

All publications referred to in this manual are listed in Section 8.

Where cross references are made, the number of the section or subsection referred to is shown in brackets.

1.2 DEFINITIONS

For the purpose of this manual,the following definitions shall hold:

Shall and **Should** - the word 'shall' is to be understood as mandatory and the word 'should' as strongly recommended to comply with the requirements of this manual.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements.
The Principal may also include an agent or consultant, authorized to act for the Principal.

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction and commissioning for the project.

The Principal may sometimes undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

Pipe sizes: The international nomenclature - **Diameter Nominal** written as DN 8, 15, 25, 40, 50 etc., has been used for pipe sizes in this manual.

2. GENERAL

Amended per Circular 48/99

The instrument air supply lines and pneumatic instrument signal lines to the instrument and/or final control element shall be made up from tubing and compression fittings as described in Section 4.

The Principal shall be consulted for special applications such as for example, 'Fire Safe' design requirements. The best arrangement shall be determined for each instrument and final control element and shown in detail on a drawing, see Section 7 for further details. The location of instruments and final control elements, including their accessibility, shall be in accordance with DEP 32.31.00.32-Gen.

3. INSTRUMENT AIR SUPPLY CONNECTIONS

Unless otherwise specified the connections on air supply lines forming part of mechanical engineering shall terminate in a $^{1}/_{2}$ inch NPT female thread.

4. GENERAL SPECIFICATION FOR AIR LINES

4.1 SPECIFICATION OF FIELD MOUNTED COMPONENTS

For general applications, the instrument air supply lines from the header up to the isolating valve(s) close to the air consumer(s) shall consist of 16 mm OD carbon steel tubing and all carbon steel compression fittings.

Instrument air supply lines from the carbon steel valve(s) to the air consumer(s) and the pneumatic signal lines shall con- sist of 6 mm OD PVC covered copper tubing and brass compression fittings. All components, the tubing and compression fittings, shall be suitable for use at 10 bar (ga) at 38°C.

Amended per Circular 48/99

Note: The application of tubing and compression fittings shall comply with the following:

- the compression fittings shall be of the make, type and composition as specified for the project by the principal and of which all parts of the fitting are made by one manufacturer
- the tubing shall be in accordance with the specification supplied by the principal
- the fittings and tubing shall be installed by skilled personnel, strictly in accordance with the manufacturer's instructions
- the instrument air lines shall be pressure tested after installation.

Each instrument and final control element requiring an air supply shall be provided with an individual air filter reducer.

The outlet of each air filter reducer shall be provided with a brass quick connector and a PVC dust cap attached by chain to the connector.

Note: The types of air filter reducers shall be kept to an absolute minimum.

The maximum number of consumers that may be connected to the same $^1/_2$ inch NPT take-off point shall be calculated, taking into account the minimum allowable inlet pressure of each air filter reducer and the total length of supply tubing, assuming maximum air consumption of all connected instruments.

Air consumers, which must stay in operation after a total air supply failure shall be provided with a back-up vessel and a lock-up device as detailed in Appendix 2. These back-up vessels form part of mechanical engineering but details for design (such as back-up time and air consumption) shall be supplied by instrument engineering.

4.2 MOUNTING OF FIELD COMPONENTS

All components such as air filter reducers, lock-up devices, solenoid valves shall be bolted to a stainless steel mounting plate which is fixed to a support with stainless steel bolts. The mounting plates shall have facilities for installing nameplates in accordance with DEP 32.37.10.34-Gen. The nameplates shall be fixed to the plates with screws.

Mounting plates shall not be supported from vibrating process pipes or on piping other than carbon steel. For such applications they shall be installed on separate supports and the reduced air supply lines and pneumatic signal line tubing shall then be sufficiently flexible to take the vibration.

Copper tubing is considered to be self supporting up to lengths of 0.5 m: , for longer lengths, the tubing shall be supported over the full length and fixed to the support at approximately 1 m intervals with cable ties.

4.3 SPECIFICATION OF CONTROL ROOM MOUNTED COMPONENTS

When specified by the principal, one or more filter/reducing station(s) shall be installed in the basement under the control room, or in the ancillary room when no basement is provided, for reducing the incoming air to the required pressure.

Separate filter/reducer stations and air headers shall be installed for:

- processing units connected to the Instrument Air Supply (IA), which may not stay in operation during a failure of the instrument air supply plant. Downstream pressure 1.5 bar (ga)
- essential units, e.g. Utility Plants, connected to the Priority Instrument Air Supply (PIA) which shall stay in operation during maintenance shutdowns or during failure of the normal air supply plant. Downstream pressure 1.5 bar (ga)
- consumers requiring higher supply pressures, e.g. for direct operation of depressurizing valves. With a downstream pressure according to specification.

Each filter/reducing station shall consist of at least two filters in parallel followed by two high-quality pressure reducers in parallel, one acting as stand-by for the other.

Each pressure reducer shall be fitted with a gauge indicating its downstream pressure. The capacity of each pressure reducer shall be such that at maximum capacity with an upstream pressure of 4.2 bar (ga) and only one reducer in operation, the specified downstream pressure is maintained.

A safety-relief valve shall be installed in the reduced air header between each reducer and the related downstream isolating valve to protect the consumers. The relief pressure setting, shall be 0.2 bar (ga) lower than the maximum allowable working pressure of the instruments supplied by the header concerned.

NOTES:
1. Oversizing of pressure reducers by more than 10% of the maximum air consumption shall be avoided to prevent unstability during normal operation and to limit the size of the safety-relief valve.

2. The exhaust port of the relief valve shall be provided with a pipe of which the outlet is located more than 2 m above floor level in a vertical direction.

The air piping upstream of the reducers shall be provided with a $^1/_2$ inch NPT female threaded connection for a pressure indicator. A $^1/_2$ inch NPT female threaded connection shall also be provided for a low pressure alarm in the reduced air piping, downstream of the isolating valves. The low pressure alarm setting shall be 0.25 bar (ga) lower than the required reduced air pressure.

The main header shall be of welded stainless steel construction with carbon steel lapped joint flanges and with stainless steel (ball type) isolating valves, installed in each branch-off to cabinets, racks or operating consoles.

The size of the air piping downstream of the reducer stations shall be based on:

- maximum air consumption of all consumers
- spare capacity of 30 percent for future extensions.

Flexible hoses shall be applied to connect the isolating valve on the main air header to the air manifolds, for typical arrangements, see Page 16 of Appendix 2.

4.4 MOUNTING OF CONTROL ROOM COMPONENTS

Prefabricated filter/reducer station(s) shall be mounted on a free standing rack.

The main reduced air header shall be installed in such a way that cable trays, exhaust and returns of air conditioning systems are not obstructed. Special attention shall be given to the supporting arrangement to prevent stresses on the flanged connections.

5. SPECIAL APPLICATIONS

5.1 GENERAL

To ensure efficient operation of the instrument air lines under all operational and climatic conditions, certain applications require provisions in addition to or in deviation from those given in (4.1), for example the use of special material.

5.2 CORROSIVE ATMOSPHERES

For corrosive atmospheres, where carbon steel tubing and compression fittings and PVC covered copper tubing may not be suitable, other materials such as AISI 316 stainless steel or aluminium bronze, etc., shall be used for all components.

NOTE: The material of construction of compression fittings shall be compatible with the material of the tubing.

However, application of these alternative materials requires the written approval of the principal.

6. PROTECTION OF COMPONENTS

Electronic instruments/components, e.g. I/P convertors, installed in the open air should be provided with a protective shade. The shade shall be installed in such a way that instruments/components can be serviced without its removal. The principal shall be consulted concerning the provision of such protection.

7. INSTALLATION DRAWINGS

A set of drawings shall be available for all air consumers, showing in detail:

- the correct position of the air consumer with respect to the connection(s)
- the method of supporting
- the arrangement of the air lines with any special provisions
- a list of the materials required.

Typical 'hook-up' drawings fulfilling the above requirements are given in Appendix 2 and summarized in Appendix 1. Copies of these drawings which shall be used for all projects are available as Standard Forms, see DEP 32.37.02.83-Gen., which are contained in the binder DEP 00.30.10.05-Gen., 'Standard Forms-Instrumentation'.

One drawing for more than one installation is allowed when the hook-ups are truly identical in the details given above.

The air lines are shown on the drawings in thick lines and all other pipelines and equipment in thin lines. The isolating valves and counter flanges which form part of mechanical engineering are shown in dotted line.

If 'hook-up' drawings other than those given in the Standard form have to be prepared, they shall be of A-4 size, using blank Standard Forms DEP 05.00.54.80-Gen., but with the DEP number removed.

The drawings shall be assembled in one set, complete with a cover sheet, an index sheets and a list of materials, etc., A typical example of such a set is shown in Appendix 2.

'Engineering notes' have been included on some of the drawings, for assistance in the proper use thereof.

For instruments requiring protection facilities, the code letter 'P' shall be indicated in the list of Section 3 - Appendix 2, 'Index of instruments'.

The quantity of material required for the installation shown, shall be indicated in the quantity column on each drawing.

The total quantities required for all instruments included shall be entered on Standard forms DEP 32.37.02.80-Gen., which provide the basis for the requisitioning of materials. A reasonable allowance of spare materials should be added.

NOTE: The contractor may wish to apply a computerized system for the handling of installation materials which should provide the following information:

- itemized material requirements per sheet
- total requirements per item
- material requisitioning.

If the contractor intends to use such a computerized system, he shall obtain agreement from the principal on the format and contents of the computer output sheets.

A 'Summary of Instrument Installation Materials' is given on Standard Forms DEP 32.37.02.80-Gen. Materials not included on these forms shall be added to the list, allocating item numbers.

8. REFERENCES

In this manual, reference is made to the following publications.

NOTE: The latest issue of each publication shall be used together with any amendments/supplements/revisions to such publications.

It is particularly important that the effect of revisions to international, national or other standards shall be considered when they are used in conjunction with DEP's unless the standard referred to has been prescribed by date.

Amended per Circular 48/99

Standard Forms - Instrumentation	DEP 00.30.10.05-Gen.
General purpose sheet	DEP 05.00.54.80-Gen.
Instrument air supply	DEP 31.37.00.11-Gen.
Piping classes	DEP 31.38.01.12-Gen.
Instruments for measurement and control	DEP 32.31.00.32-Gen.
Summary of instrument installation materials	DEP 32.37.02.80-Gen.
Instrument impulse lines	DEP 32.37.10.11-Gen.
Instrument nameplates	DEP 32.37.10.34-Gen.

9. APPENDICES

	Appendix
Reference to the typical 'hook-up' drawings given in Appendix 2.	1
Instrument Air Lines	2

APPENDIX 1 REFERENCE TO THE TYPICAL 'HOOK' DRAWINGS GIVEN IN APPENDIX 2

NOTE: Figures in the right hand column refer to sheet numbers in Appendix 2

INSTRUMENT AIR SUPPLY		
In the control centre	- filter/reducer station	801, 802
	- air distribution in the auxiliary room	803
In the plant	- air supply to consumer(s)	804, 805
	- air supply with lock-up device and back-up cylinder	806
INSTRUMENT AIR LINES		
Pneumatic transmitter		901
Control Valve	- with positioner	902
	- with positioner and booster	903
	- with positioner and lock-up device	904 905
	- with solenoid valve	906
	- with solenoid valve and quick exhaust	907
	- with positioner and solenoid valve	908
	- with solenoid valve and lubricator	909
	- with solenoid valve, lubricator and quick exhaust	
Convertors, installed on a rack		910

APPENDIX 2 INSTRUMENT AIR LINES

Section 1 - Cover sheet

INSTRUMENT AIR LINES

Section	Sheets	Subject
1	1	Cover sheet
2	201	Index of sheets
3	301	Index of instruments
4	401	Typical components
5	501 – 503	Installation notes
6	601 – 606	Instrument supports
7	701	Symbols
8	801 – 806	Instrument air supply
9	901 – 910	Field mounted components

Engineering notes:

1. For guidance during the preparation of the set of drawings for instrument air lines, the following pages show the general arrangement of the sheets, as well as a number of typical examples of the drawings.
   For further details, see Section 8 and 9 of this appendix.

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 1 – Cover sheet	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 1 cont'd on sheet No. 201 Drawing No. T					

Section 2 - Index of sheets

Sheet No.	Issue	Revision date					Sheet No.	Issue	Revision date			
	O	A	B	C	D			O	A	B	C	D

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 2 – Index of sheets	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by :			Sheet No. 201	cont'd on sheet No. 301			
Principal :			Drawing No. T				

Section 3 - Index of instruments

Tag No.	Mounting			Air lines	Protecting facilities	Tag No.	Mounting			Air lines	Protecting facilities
	Support		Plate				Support		Plate		
	Type	Size	Yes/No	Sheet No.	P		Type	Size	Yes/No	Sheet No.	P

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 3 – Index of instruments	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by :			Sheet No. 301 cont'd on sheet No. 401				
Principal :			Drawing No. T				

Section 4 - Typical components

Issue	Mat. item	Code size or connection	Description	Material	MESC
	006	2 inch NPT	Instrument air filter		
	011	1/4 in. NPT	Instrument air filter regulator		
	013	1/2 in. NPT	Instrument air regulator		
	016	2 inch NPT	Instrument air regulator		
	017	–	Pilot regulator		
	018	–	Regulator gauge 0-1.6 bar		
	019	–	Pilot regulator connection kit		
	026	1/2 x 1/4 in. NPT	Air manifold with 5 valves	Brass	
	028	1/4 in. NPT	4 way air block	Brass	
	084	1/4 in. NPT	Port protector	Brass	
	409	DN 50	Line pipe schedule 40S	SS	
	410	DN 80	Line pipe schedule 10S	SS	
	414	16 mm OD	Tubing	CS	
	444	6 mm OD	Tubing – black PVC sheathed	Cu	
	508	1/2 in. NPT	Ball valve screwed	CS	
	525	1/2 in. NPT	Ball valve screwed	SS	
	530	DN 50	Ball valve flanged	CS	
	532	DN 50	Ball valve flanged	SS	
	604	1/4 in. x 40 mm	Nipple – screwed	Brass	
	609	1/4 in. NPT	Plug – screwed	Bronze	
	610	1/2 in. NPT	Plug – screwed	Bronze	
	611	1/2 x 1/4 in.	Bushing – screwed	Bronze	
	646	1/2 in. x 75 mm	Nipple – screwed/bevelled sch 40S	SS	
	648	1 in. x 75 mm	Nipple – screwed/bevelled sch 40S	SS	
	650	2 in. x 75 mm	Nipple – screwed/bevelled sch 40S	SS	
	668	DN 50	Elbow schedule 40S	SS	
	672	DN 50	Stub end schedule 40S	SS	
	674	DN 80	Stub end schedule 40S	SS	
	677	DN 50 x 25	Reducer schedule 40S	SS	
	679	DN 80 x 50	Reducer schedule 40S	SS	
	683	DN 50	Tee schedule 40S	SS	
	685	DN 50	Flange – blind	CS	
	688	DN 50	Flange – lapped joint	CS	
	690	DN 80	Flange – lapped joint	CS	
	692	DN 50	Flange – blind	SS	
	783	16 mm x 1/2 in.	Male connector compression type	CS	
	789	16 mm OD	Union tee compression type	CS	
	792	16 mm OD	Union compression type	CS	
	803	6 mm x 1/4 in.	Male connector compression type	Brass	
	837	6 mm OD	Union tee compression type	Brass	
	892	1/4 in. NPT	Quick connector make	Brass	
	893	4 mm	Dust cap	PVC	
	951	5/8 in. x 80 mm	Stud bolt with 2 nuts	Alloy	
	998	DN 50	Gasket	CAF	

Notes: This list is typical.
For complete material specification, see standard form
'Summary of Instrument Installation Materials' DEP 32.37.02.80 - Gen.

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 4 – Typical components	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by :			Sheet No.401 cont'd on sheet No. 501					
Principal :			Drawing No. T					

Section 5 - Installation notes

INSTALLATION NOTES

Before and during the actual installation of the instruments and their air lines the following points shall be observed.

LOCATION

The attached drawings show in general the required position of the instrument(s) relative to the connection points. The exact location shall be determined at site; the responsible instrument engineer shall mark this location on the process equipment, plant structures, etc.

All instruments shall be installed with the instrument centre approximately 1.3 m above floor level, grade or platform.

All instruments shall be installed in such a way that they are not subject to vibration and/or extreme environmental conditions, and do not obstruct traffic. Instruments shall not be located under places with potential leakage.

The minimum clearance between any part of the instrument mounting plate and surrounding structures or equipment shall not be less than 0.2 m.

INSTRUMENT SUPPORTS

When specified in Section 3, each instrument shall be provided with a support as detailed in Section 6.

Subject to approval by principal's instrument engineer, more than one mounting plate may be attached to one instrument support instead of separate supports as shown on the relevant drawing.

Supports at grade or on concrete floors shall have concrete footings.

Pipe supports shall not be mounted on process pipes other than carbon steel and smaller than DN 50.

TUBING AND COMPRESSION FITTINGS

The tubing shall be cut dead square with a tube cutter; the edges shall be deburred.
The tube end shall be undamaged, round and without scratches over the length which fits into the compression fitting. Any coating or painting shall be removed.

Tubes shall be bent with a high-quality tube bender which shall have a minimum bending radius as specified by the tubing manufacturer.

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 5 – Installation notes	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by :			Sheet No. 501 cont'd on sheet No. 502				
Principal :			Drawing No. T				

Section 5 - Installation notes(cont'd)

Long lengths of tubing shall be supported over the full length and fixed to the support at intervals of approximately 1 m.

Where final control elements may change position relative to the instrument, e.g. due to thermal expansion the air lines shall be so arranged that undue stresses on the compression fittings are prevented.

When tightening compression fittings, the following instructions shall be carefully adhered to.

Insert tubing in the fitting until it rests firmly against the shoulder in the fitting, turn the nut finger-tight, and turn nut with spanner over another 1¼ turns, holding fitting body with a back-up spanner.

Note: The principal's instrument engineer shall confirm this procedure.

THREAD SEALANT

NPT threaded connections require PTFE tape (MESC 85.15.78.038.1) to prevent seizing and leakage.

The tape shall be applied as follows:

Place tape on male thread, leaving two threads at the small end free from tape, hold in place and wrap clockwise only once with a slight overlap. Draw tightly around threads so that it conforms to the threaded surface.

PRESSURE TESTING, etc.

For procedures of pressure testing, applying seal liquid, commissioning, etc., see DEP 62.37.10.12 - Gen.

Note: Instrument air supply and pneumatic signal lines shall only be pressure tested with compressed air.

CODES FOR PROTECTION FACILITIES

The codes as specified in section 3 are:

P = protective shade.

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 5 – Installation notes	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 502 cont'd on sheet No. 601 Drawing No. T					

Section 6 - Instruments supports

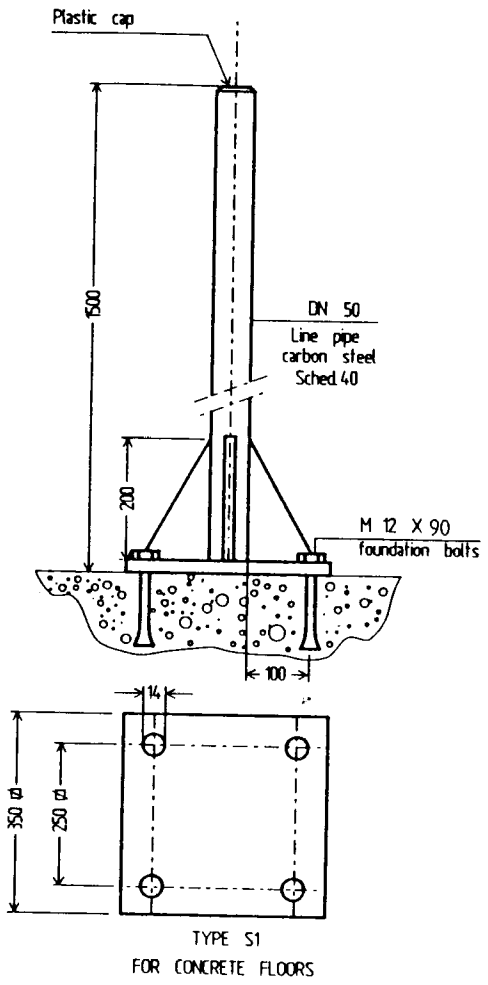
CODES FOR INSTRUMENT SUPPORTS

Type code	Description	Sheet	Notes
S1	Support for floor mounting	602	
S2	Support for platform mounting	603	
S3	Support for unpaved areas	604	
S4	Straight support for line mounting	605	1
S5	Angle support for line mounting	606	1

Note: Observe pipe size (in DN) as specified in Section 3.

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 6 – Instruments supports	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 601 cont'd on sheet No. 602 Drawing No. T					

Section 6 - Instruments supports(cont'd)

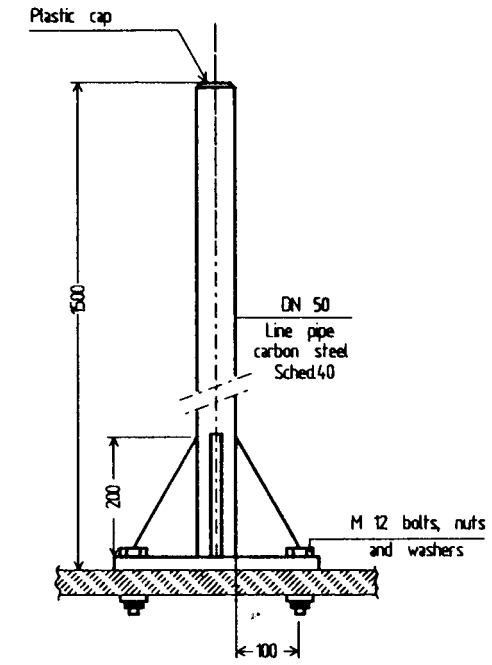


NOTES:

1) Plates and strips carbon steel 10 mm thick.
2) Finish: after shotblasting a preserving agent shall be applied as per requisition.

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Support type S1	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 6 – Instrument supports	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by :			Sheet No. 602 cont'd on sheet No. 603					
Principal :			Drawing No. T					

Section 6 - Instruments supports(cont'd)



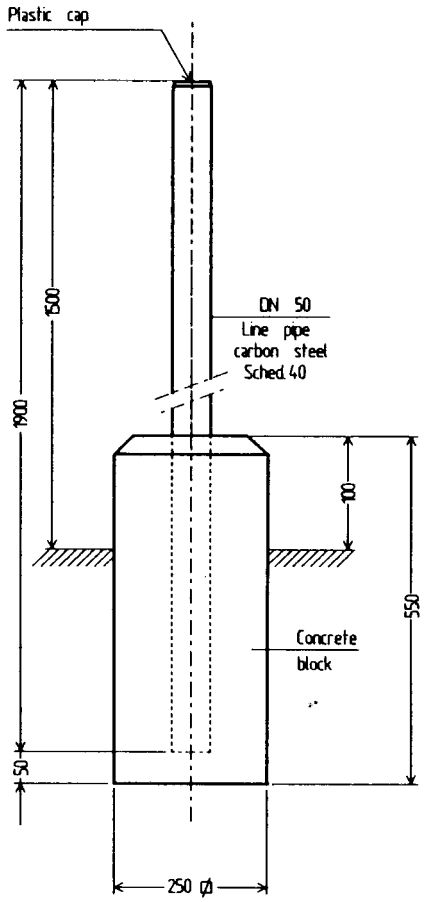
TYPE S2
FOR GRATING AND STEEL PLATFORMS

NOTES:

1) Plates and strips carbon steel 10 mm thick.
2) Finish: after shotblasting a preserving agent shall be applied as per requisition.

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Support type S2	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 6 – Instrument supports	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by :			Sheet No. 603 cont'd on sheet No. 604				
Principal :			Drawing No. T				

Section 6 - Instruments supports(cont'd)



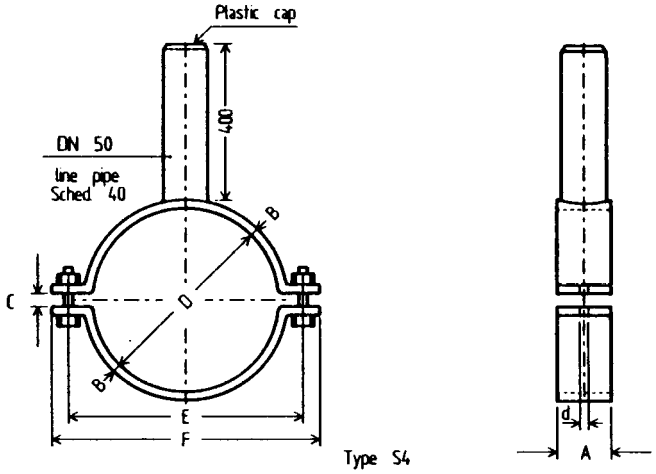
TYPE S3
FOR UNPAVED AREAS

NOTE:

1) Finish: after shotblasting a preserving agent shall be applied as per requisition.

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Support type S3	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 6 – Instrument supports	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by : Principal :			Sheet No. 604 cont'd on sheet No. 605 Drawing No. T				

Section 6 - Instruments supports(cont'd)



Type S4
Straight support for line mounting

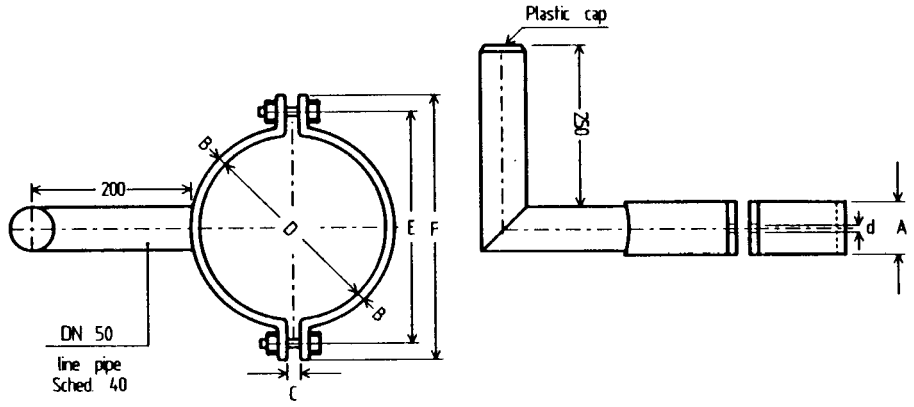
NOTE:

1) Material of clamps : carbon steel
Cap : plastic
Line pipe : carbon steel
Bolts and nuts : unified black hexagon, heavy series – UNC thread
Finish : after shotblasting a preserving agent shall be applied as per requisition.

Nom. line size DN	Dimensions in millimetres							Bolt data Dia. x length in. x mm.
	A	B	C	D	E	F	Bolt hole d	
50	65	5	10	61	120	170	22	3/4 x 40
80				90	150	200		
100			12	115	180	230		3/4 x 34
150		8		169	250	300		3/4 x 50
200				220	300	350		
250	75	10	20	274	360	410		3/4 x 65
300				324	420	470		
350		12		356	460	510		3/4 x 70
400				408	520	570		
450				458	570	620		
500				508	620	670		

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:	Support type S4	Date				
Appr. by :	Date:	Section 6 – Instrument supports	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by :			Sheet No. 605 cont'd on sheet No. 606				
Principal :			Drawing No. T				

Section 6 - Instruments supports(cont'd)



Type S5

Angle support for line mounting

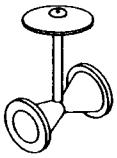
NOTE:

1) Material of clamps : carbon steel
   Cap : plastic
   Line pipe : carbon steel
   Bolts and nuts : unified black hexagon, heavy series -- UNC thread
   Finish : after shotblasting a preserving agent shall be applied as per requisition.

Nom. line size DN	Dimensions in millimetres							Bolt data Dia. x length in. x mm.
	A	B	C	D	E	F	Bolt hole d	
50	65	5	10	61	120	170	22	3/4 x 40
80				90	150	200		
100			12	115	180	230		3/4 x 34
150		8		169	250	300		3/4 x 50
200				220	300	350		
250	75	10	20	274	360	410		3/4 x 65
300				324	420	470		
350		12		356	460	510		3/4 x 70
400				408	520	570		
450				458	570	620		
500				508	620	670		

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Support type S5	Issue
Checked by :	Date:		Date
Appr. by :	Date:	Section 6 -- Instrument supports	By
LOCATION:	PLANT:		Project & group No.:
Eng. by : Principal :			Sheet No. 605 cont'd on sheet No. 701 Drawing No. T

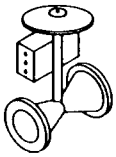
Section 7 - Symbols



CONTROL VALVE WITHOUT POSITIONER

QUICK EXHAUST VALVE

I/P CONVERTER



CONTROL VALVE WITH POSITIONER

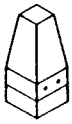
AIR LUBRICATOR

SOLENOID VALVE

INSTRUMENT AIRFILTER REGULATOR

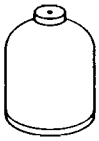
BOOSTER

5-WAY AIR MANIFOLD



TRANSMITTER

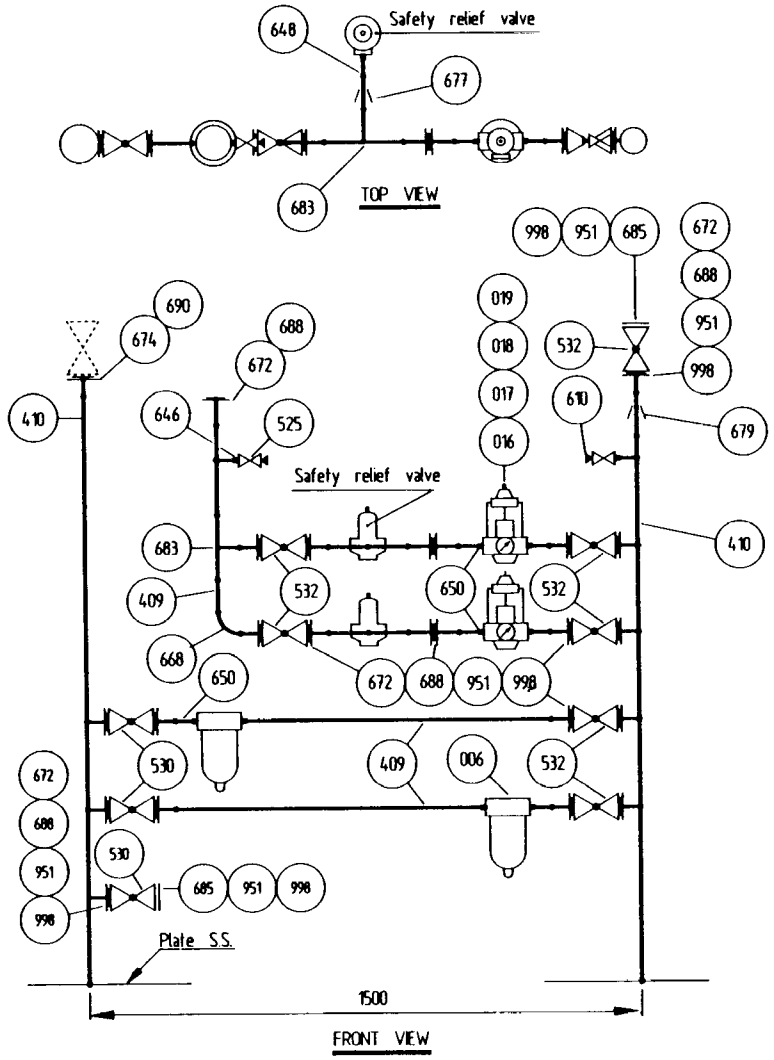
LOCK-UP DEVICE



BUFFER VESSEL

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 7 – Symbols	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by : Principal :			Sheet No. 701 cont'd on sheet No. 801 Drawing No. T				

Section 8 - Instrument air supply



NOTE:
1) For materials see sheet 802

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue				
Checked by :	Date:	Filter/reducer station	Date				
Appr. by :	Date:	Section 8 – Instrument air supply	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by : Principal :			Sheet No. 801 cont'd on sheet No. 802 Drawing No. T				

Section 8 - Instrument air supply(cont'd)

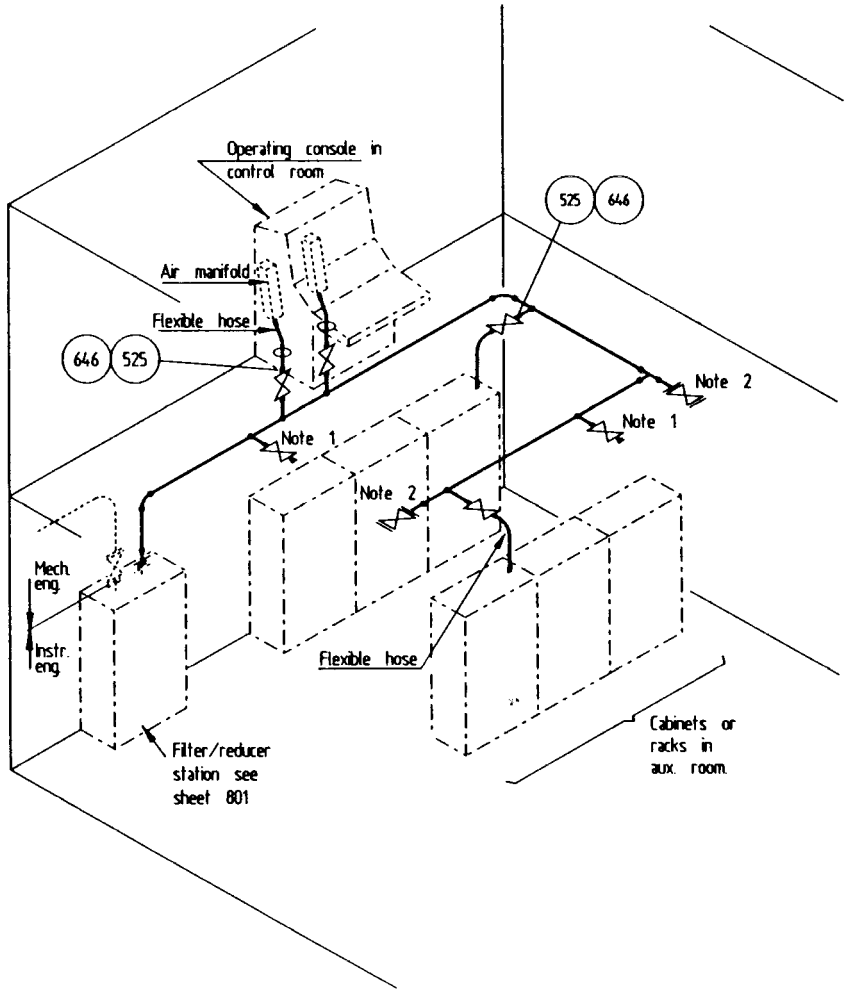
Item	Quantity	Code size or Connection	Description	Material	MESC
006	2	2 in. NPT	Instrument air filter		
016	2	2 in. NPT	Instrument air regulator		
017	2	–	Pilot regulator		
018	2	–	Regulator gauge 0-1.6 bar		
019	2	–	Pilot regulator connection kit		
409	2 m	DN 50	Line pipe schedule 40S	SS	
410	4.5 m	DN 80	Line pipe schedule 10S	SS	
525	2	1/2 in. NPT	Ball valve screwed	SS	
530	3	DN 50	Ball valve flanged	CS	
532	6	DN 50	Ball valve flanged	SS	
610	2	1/2 in. NPT	Plug screwed	Bronze	
646	2	1/2 in. x 75 mm	Nipple screwed/bevelled	SS	
648	2	1 in. x 75 mm	Nipple screwed/bevelled	SS	
650	6	2 in. x 75 mm	Nipple screwed/bevelled	SS	
668	1	DN 50	Elbow schedule 40S	SS	
672	23	DN 50	Stub-end schedule 40S	SS	
674	1	DN 80	Stub-end schedule 10S	SS	
677	2	DN 50x25	Reducer schedule 40S	SS	
679	1	DN 80x50	Reducer schedule 40S	SS	
683	2	DN 50	Tee schedule 40S	SS	
685	2	DN 50	Flange – blind	CS	
688	23	DN 50	Flange – lapjoint	CS	
690	1	DN 80	Flange – lapjoint	CS	
951	88	5/8 in. x 80 mm	Stud bolt with 2 nuts	Alloy	
998	22	DN 50	Gasket	CAF	

NOTE:

1) Material list for sheet 801

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Filter/reducer station	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 8 – Instrument air supply	By					
LOCATION:		PLANT:	Project & group No.:					
Eng. by :			Sheet No. 802 cont'd on sheet No. 803					
Principal :			Drawing No. T					

Section 8 - Instrument air supply(cont'd)



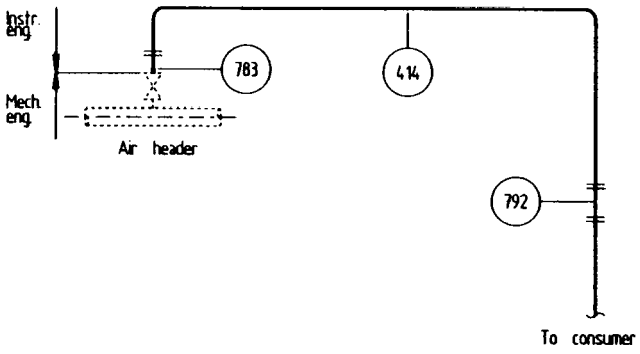
NOTES:

1) Spare connection
2) Valve at end of piping for future extension
3) The air manifold block in the console to be supplied by panel manufacturer.
4) For item number see sheet 401.

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Distribution in auxiliary room	Issue				
Checked by :	Date:		Date				
Appr. by :	Date:	Section 8 – Instrument air supply	By				
LOCATION:		PLANT:	Project & group No.:				
Eng. by : Principal :			Sheet No. 803 cont'd on sheet No. 804 Drawing No. T				

Section 8 - Instrument air supply(cont'd)

Tag No.

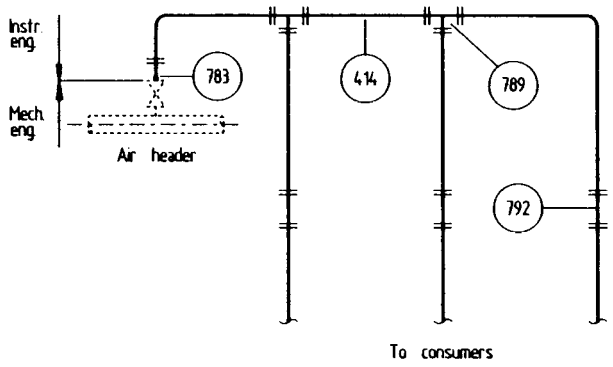


Item	Quantity	Size or connection	Description	Material	MESC
414	9 m	16 mm OD	Tubing	CS	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
792	1	16 mm	Union compression type	CS	

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:	Air supply to one consumer	Date					
Appr. by :	Date:	Section 8 – Instrument air supply	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by :			Sheet No. 804 cont'd on sheet No. 805					
Principal :			Drawing No. T					

Section 8 - Instrument air supply(cont'd)

Tag No.



Engineering note:

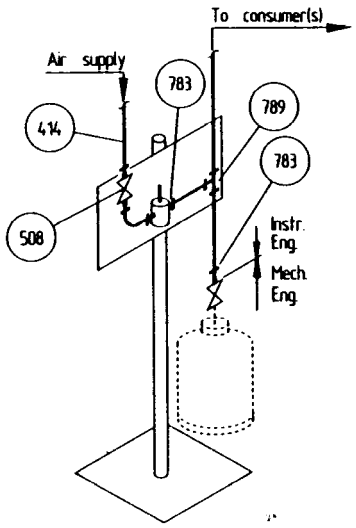
1) Total quantity of materials to be determined by engineering.

Item	Quantity	Size or connection	Description	Material	MESC
414		16 mm OD	Tubing	CS	
783		16 mm x 1/2 in.	Male connector compression type	CS	
789		16 mm OD	Union tee compression type	CS	
792		16 mm OD	Union compression type	CS	

Made by :	Date:	Title: **INSTRUMENT AIR LINES**	Issue					
Checked by :	Date:	Air supply to consumers	Date					
Appr. by :	Date:	Section 8 – Instrument air supply	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 805 cont'd on sheet No. 806 Drawing No. T					

Section 8 - Instrument air supply(cont'd)

Tag No.



Installation note:

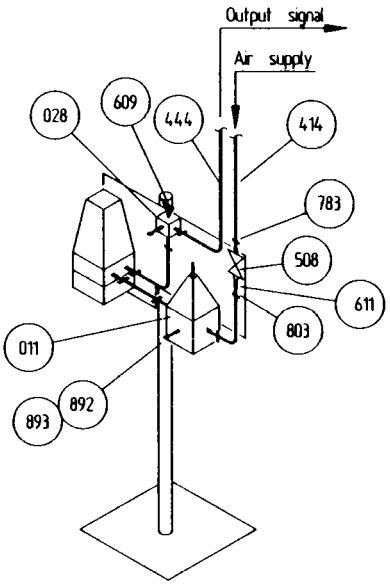
1) Valve (item 508) and lock-up device shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
414	6 m	16 mm OD	Tubing	CS	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
783	5	16 mm x 1/2 in.	Male connector compression type	CS	
789	1	16 mm OD	Union tee compression type	CS	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Lock-up device and back-up cylinder		Issue				
Checked by :	Date:			Date				
Appr. by :	Date:	Section 8 – Instrument air supply		By				
LOCATION :		PLANT:		Project & group No.:				
Eng. by : Principal :				Sheet No. 806 cont'd on sheet No. 901 Drawing No. T				

Section 9 - Field mounted components

Tag No.



Installation note:

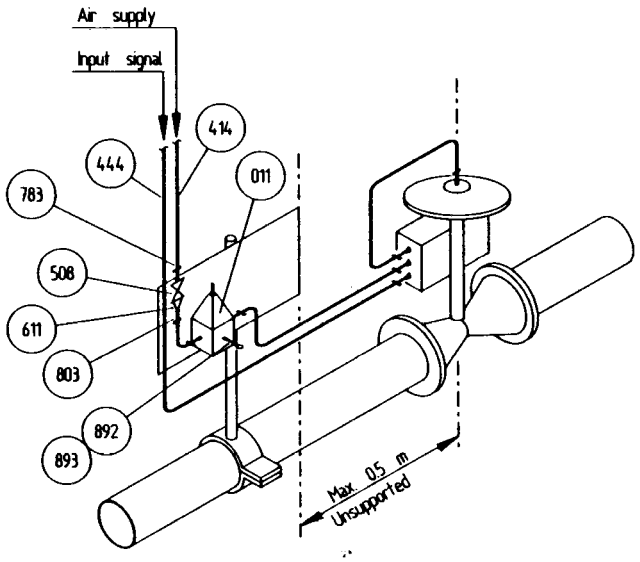
1) Input signal (item 444) shall be routed close to instrument air supply (item 414).
2) Items 011 and 508 shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
028	1	1/4 in. NPT	4 way air block	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
609	1	1/4 in. NPT	Plug	Bronze	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	7	6 mm x 1/4 in.	Male connector compression type	Brass	
892	2	1/4 in.	Quick connector male	Brass	
893	2	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Pneumatic transmitter	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 901 cont'd on sheet No. 902 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation note:

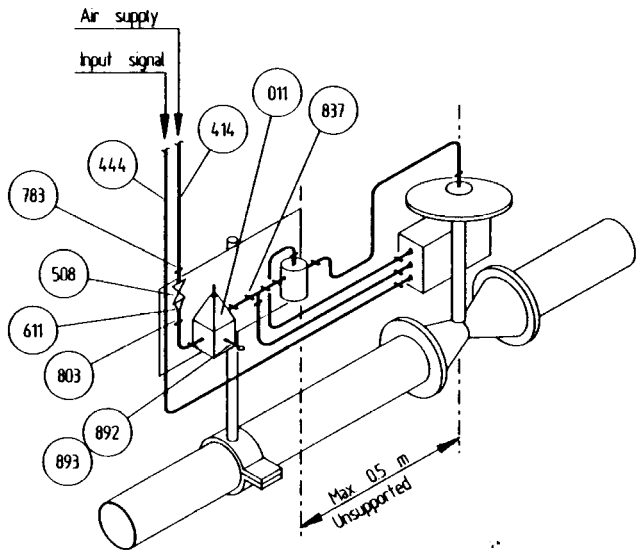
1) Input signal (item 444) shall be routed close to instrument air supply (item 414).
2) Items 011 and 508 shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	7	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in.	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with positioner	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 902 cont'd on sheet No. 903 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation note:

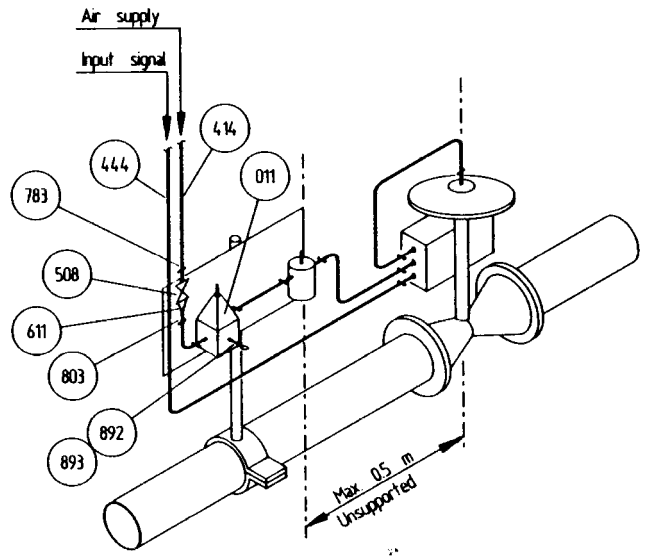
1) Input signal (item 444) shall be routed close to instrument air supply (item 414).
2) Items 011 and 508 shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	10	6 mm x 1/4 in.	Male connector compression type	Brass	
837	1	6 mm OD	Union tee compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with positioner and booster	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 903 cont'd on sheet No. 904 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation note:

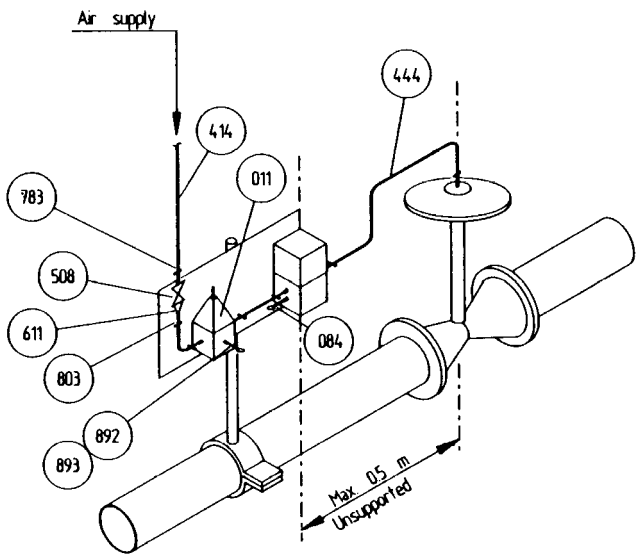
1) Input signal (item 444) shall be routed close to instrument air supply (item 414).
2) Items 011 and 508 shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	9	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in.	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with positioner and lock-up device	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 904 cont'd on sheet No. 905 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



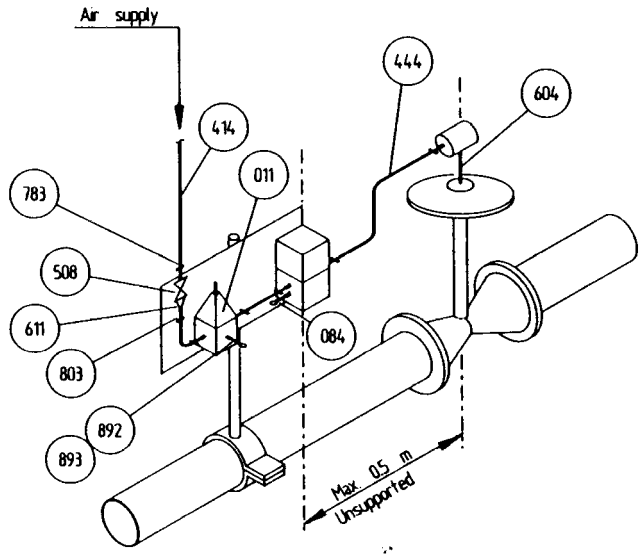
Installation note:
1) Items 011, 508 and solenoid valve shall be fixed in the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
084	1	1/4 in. NPT	Port protector	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	2 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	6	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with solenoid valve	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 905 cont'd on sheet No. 906 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



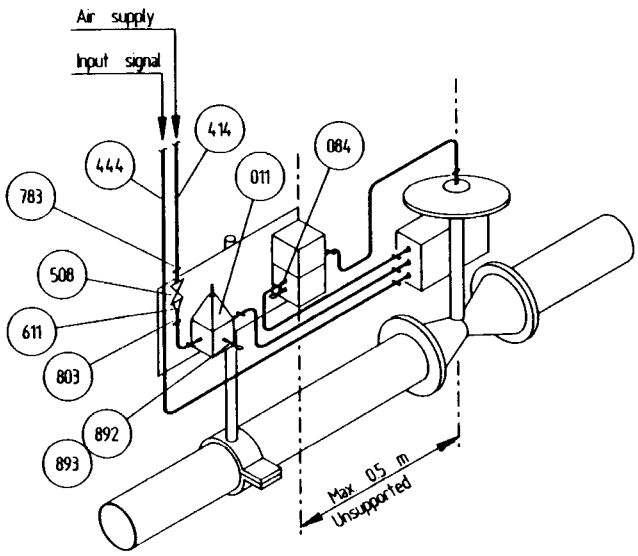
Installation note:
1) Items 011, 508 and solenoid valve shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
084	1	1/4 in. NPT	Port protector	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	2 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
604	1	1/4 in. x 40 mm	Nipple – screwed	Brass	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	6	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with solenoid valve and quick exhaust	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by :			Sheet No. 906 cont'd on sheet No. 907					
Principal :			Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation note:

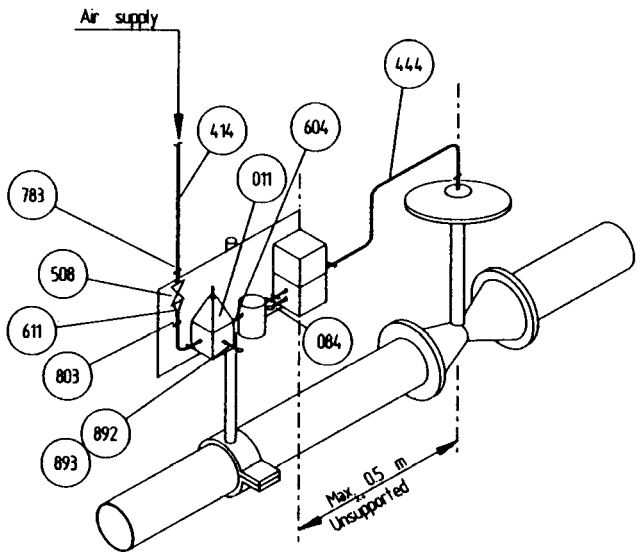
1) Input signal (item 444) to be routed close to instrument air supply (item 414).
2) Items 011, 508 and solenoid valve shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
084	1	1/4 in. NPT	Port protector	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	9	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with positioner and solenoid valve	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 907 cont'd on sheet No. 908 Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



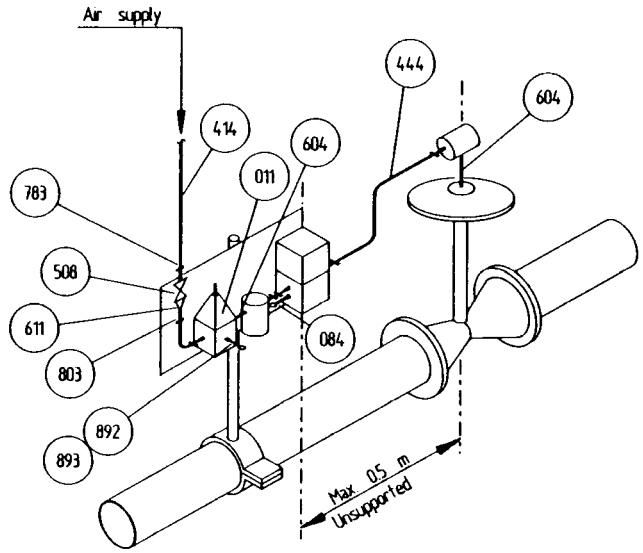
Installation note:
1) Items 011, 508 and solenoid valve shall be fixed in the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
084	1	1/4 in. NPT	Port protector	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	2 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
604	1	1/4 in. x 40 mm	Nipple – screwed	Brass	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	6	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with solenoid valve and lubricator	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by :			Sheet No. 908 cont'd on sheet No. 909					
Principal :			Drawing No. T					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation note:

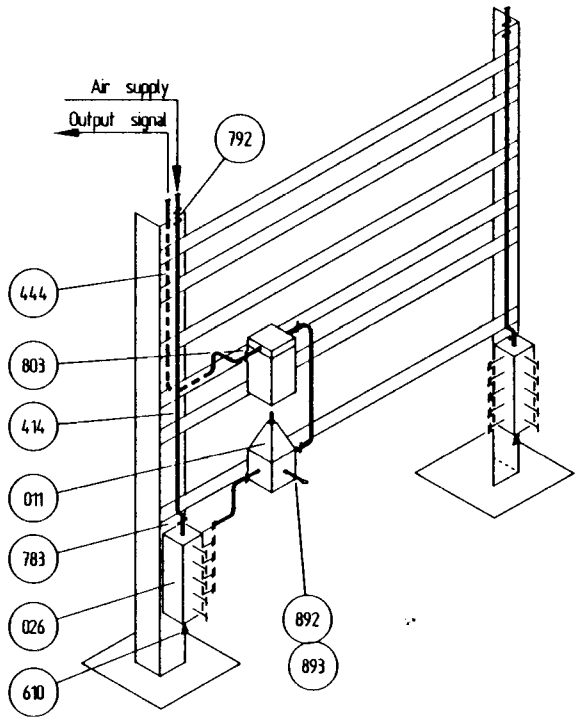
1) Items 011, 508 and solenoid valve shall be fixed to the mounting plate.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
084	1	1/4 in. NPT	Port protector	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	2 m	6 mm OD	Tubing – black PVC sheated	Cu	
508	1	1/2 in. NPT	Ball valve – screwed	CS	
604	2	1/4 in. x 40 mm	Nipple – screwed	Brass	
611	1	1/2 x 1/4 in.	Bushing – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
803	6	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Control valve with solenoid valve lubricator and quick exhaust	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 909 cont'd on sheet No. 910 Drawing No. **T**					

Section 9 - Field mounted components(cont'd)

Tag No.



Installation notes:

1) Output signal (item 444) to be routed close to instrument air supply (item 414)
2) Quantity of items 036, 414, 610, 730 and 792 is for every 5 tag no's.

Item	Quantity	Size or connection	Description	Material	MESC
011	1	1/4 in. NPT	Instrument air filter regulator	–	
026	1	1/2 x 1/4 in.	Air manifold with 5 valves	Brass	
414	6 m	16 mm OD	Tubing	CS	
444	16 m	6 mm OD	Tubing – black PVC sheated	Cu	
610	1	1/2 in. NPT	Plug – screwed	Bronze	
783	1	16 mm x 1/2 in.	Male connector compression type	CS	
792	1	16 mm OD	Union compression type	CS	
803	5	6 mm x 1/4 in.	Male connector compression type	Brass	
892	1	1/4 in. NPT	Quick connector male	Brass	
893	1	4 mm	Dust cap	PVC	

Made by :	Date:	Title: **INSTRUMENT AIR LINES** Convertors installed on rack	Issue					
Checked by :	Date:		Date					
Appr. by :	Date:	Section 9 – Field mounted components	By					
LOCATION :		PLANT:	Project & group No.:					
Eng. by : Principal :			Sheet No. 910 cont'd on sheet No. Drawing No. T					