NORSOK STANDARD

ELECTRICAL, INSTRUMENTATION AND TELECOMMUNICATION INSTALLATION

Z-010
Rev. 3, Oct. 2000

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FOREWORD

NORSOK (The competitive standing of the Norwegian offshore sector) is the industry initiative to add value, reduce cost and lead time and eliminate unnecessary activities in offshore field developments and operations.

The NORSOK standards are developed by the Norwegian petroleum industry as a part of the NORSOK initiative and supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Manufacturing Industries). NORSOK standards are administered and issued by NTS (Norwegian Technology Standards Institution).

The purpose of NORSOK standards is to contribute to meet the NORSOK goals, e.g. to develop standards that ensure value adding and cost effectiveness for all parties involved and thus are used in existing and future petroleum industry developments

The NORSOK standards make extensive references to international standards. Where relevant, the contents of a NORSOK standard will be used to provide input to the international standardisation process. Subject to implementation into international standards, the NORSOK standard will be withdrawn.

Annex is informative.

INTRODUCTION

This standard replaces and supersedes previous NORSOK standard Z-010, Electrical, instrument and telecommunication installation rev. 2, December 1997. This standard has been given revision 3 as being a continuation from Z-010 rev. 2.

It should be noted that this standard should be read in conjunction with NORSOK standards E-001 “Electrical systems”, I-001 “Field instrumentation”, I-002 “Safety and automation systems” and T-CR-001 “Telecommunication systems” covering allied subjects.

1 SCOPE

This NORSOK standard covers functional and technical requirement related to installation of electrical, instrumentation and telecommunication equipment.

In addition the standard establish basis for engineering of typical areas like cable segregation, cable requirements, Ex-philosophies, equipment enclosures etc.

2 NORMATIVE REFERENCES

The following standards include provisions, which, through reference in this text, constitute provisions of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

FEU	Regulation on electrical equipment.
Norwegian Directorate for Product and Electrical Safety	Guidelines for earthing in maritime installations.
EN 50081-2	Electromagnetic compatibility Generic emission standard, Part2: Industrial environment.
EN 50082-2	Electromagnetic compatibility Generic immunity standard, Part 2: Industrial environment.
IEC 60529	Degrees of protection provided by enclosures (IP code)
IFEA	Veiledning for varmekabelanlegg i industri og offshore. Guidelines for heat tracing installation in industry and offshore. (Norwegian text only)
NEK 606	Cables for offshore installations Halogen-free, or mud resistant.
NORSOK S-DP-001	Technical safety (will be renumberedS-001)
NORSOK Z-DP-002	Coding system
NORSOK M-501	Surface Preparation and Protective Coating

Systems of units

The SI system of units shall be applied.

3 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

All terms and phrases within the scope of this standard shall be regarded as defined in the regulations and international codes and standards referred to in this document.

Normative references	Shall mean normative in the application of NORSOK standards.
Shall	Shall is an absolute requirement which shall be followed strictly in order to conform to the standard.
Should	Should is a recommendation. Alternative solutions having the same

May	Verbal form used to indicate a cource of action permissible within the limits of the standard.
Can	Verbal form used for statements of possibility and capability, wether material, physical or casual.

3.2 Abbreviations

AISI	American Iron Steel Institute
APS	Abandon Platform Shutdown
ASDS	Adjustable Speed Drive System
CAS	Communal Aerial System
CCR	Central Control Room
CCTV	Closed Circuit Television
ESD	Emergency shutdown
IE	Instrument Earth
IFEA	Industriens Forening for Elektroteknikk og Automatisering. (The Association for Electrotechnics and Automation in Industry)
IP	International Protection
IS	Intrinsically Safe
LER	Local Equipment Room
MCT	Multi cable Transit
NEK	Norsk Elektroteknisk Komite (The Norwegian national committee of the international electrotechnical commission, IEC, The European committee for electrotechnical standardization CENELEC.)
PA	Public Address and Alarm System
PABX	Telephone System
PE	Protective Earth
EMC	Electromagnetic compatibility

4 FUNCTIONAL REQUIREMENTS

4.1 General

Ex-certified equipment shall be selected in accordance with the following requirements:

- Ex i and Ex e should be used.
- Ex n may be used in zone 2.
- Ex d and Ex p should be avoided.
  However, if Ex d equipment is used, it should be provided with an Ex e indirect entry. For motor installations see E-001 Electrical Systems,paragraf 6.5.2 tabel 4
- Ex s or Ex m solenoid valves are preferred.
- Equipment, which shall remain energised after an APS/ESD situation, shall follow the requirement specified in NORSOK standard Technical safety, S-DP-001.

4.2 Degree of Protection (IP-Code)

Minimum degree of protection provided by enclosure shall be:

For outdoor, in naturally ventilated areas and wash down areas	IP 56 (note 1)
Dry indoor areas	IP 20
Other areas	IP 44

Above represents minimum requirements. It should be noted that regulations may contain more stringent requirements and must be consulted.

Note 1: IP 56 is required where equipment is placed in open deck exposed to water from heavy seas or in areas exposed to water projected jets, elsewhere IP 55 is required.

4.3 Spare requirements for future modifications

The requirements are related to spare at the time of plant start-up.

The installation should be prepared for:

- Relevant area interface cabinets, junction boxes, cabling etc. to meet a 10 % increase.
- Main cable ladders to meet a 10 % increase.

4.4 Equipment location

Equipment should be located in accordance with the following requirements:

- Protected against damage.
- Protected against vibration.
- Protected against weather and water jets.
- Operability and serviceability.
- Display instruments and flashing lights to be legible and visible from main access areas or walkways.
- Accessibility for maintenance without scaffolding, stepladder etc.

Electrical equipment shall, unless unavoidable due to the functionality or necessity, be installed indoor and away from hazardous areas.

Instruments that have to be installed in exposed areas should be sheltered by use of weather protection or enclosure.

Final location shall be selected to avoid interference with escape routings, walkways, other equipment, pipes etc. and obstruction against activities related to transport and lifting operations.

Equipment should not be supported on pipe work, handrails, access ladders or cable ladders. Lighting fixtures may however be mounted underneath cable ladders or as integrated part of handrail support arrangement

Equipment such as PA flashing lights, loudspeakers, junction boxes, splitters and tap-off may be located on the support for cable ladders and trays or cable ladder's side rail.

Equipment shall not be mounted on blastwalls/explosion relieves. Equipment can however be installed on the support frames for the blast walls if the integrity of the blast wall is not interfered.

Equipment located in areas which do not allow for maintenance accessibility as required, should as shown on typical drawing be installed such that the equipment can be rotated, raised or lowered into areas where maintenance can take place without the need for scaffolding.

4.5 Electromagnetic compatibility (EMC)

All equipment and installations shall comply with Norwegian Directorate for Product and Electrical Safety: Regulation on electrical equipment Chapter IV, regarding electromagnetic compatibility requirements with respect to both emission and immunity. The EMC susceptibility or EMC emission is not impaired for the complete installation.

5 LIGHTING AND SMALL POWER

5.1 Lighting

Cables shall be looped between lighting fixtures, independent of the sequence numbers used for fixture identification.

The use of junction boxes should be avoided.

If junction boxes have to be used, they shall be installed easily accessible.

5.2 Control stations (Push buttons)

Control stations shall be located approximately 1500 mm above deck level measured to center of control station, and located adjacent to the equipment which it controls without obstructing removal of the equipment. Location shall also be where it is practical for operation – close to gangways etc.

5.3 Sockets outlets

Special considerations should be made to the use, when finalizing the location of socket outlets in offices and similar areas like control rooms, laboratories, and workshops. As a guideline the location should be approximately 300 mm above fixed floor level or in cable chanels/ducts above desk height.

In other areas, outdoor, process etc., the socket outlets shall be located approximately 1500 mm above deck level measured to center of socket outlet.

6 HEAT TRACING

6.1 General

The installation shall comply with "Veiledning for varmekabelanlegg i industri og offshore", published by IFEA. Supplier installation requirements shall be adhered to.

6.2 Installation of heat tracing cables

Heat tracing cables shall be strapped to equipment and pipes using glass fiber tape, spaced approximately at 300 mm intervals along pipes and as required elsewhere. Stainless steel straps, AISI 316, or high temperature glass fiber tape shall be used on high temperature cables.

Heat tracing cables should be installed along the lower semi-circle of the pipes.

Cables shall pass through thermal insulation from below or side on vertical pipes.

Heat tracing cables shall be installed in such a way that it allows dismantling of joints, valves, instruments etc. without cutting or damaging the cable.

Where the heat tracing cables are crossing flanges, thermal insulation covers or other sharp edges, protectors of stainless steel AISI 316 shall be used.

Heat tracing cables should not be spliced.

Purpose made flexible stainless steel conduit shall be used for protection of the heat tracing cable between stand alone junction boxes and insulation entry kit.

Flexible conduits protecting heat tracing cables shall be fixed to support approximately every 200 mm.

Heat tracing cables shall be 100 % covered. Exceptions may be in instrument enclosures.

The heat tracing cable should be protected against damage by applying an aluminium tape/foil on top of the cable when cellular glass is used as insulation material.

6.3 Heat tracing junction boxes

Junction boxes should be installed directly to pipes or on steel supports adjacent to the pipe or instrument.

7 INSTRUMENT AND TUBING

7.1 In-line instruments

All in-line instruments shall be installed in accordance with supplier recommendations.

Prior to final installation of control valve and other in-line instruments, process lines shall be properly flushed.

7.2 Off-line instruments

Each instrument shall be available for maintenance and disconnection without interfering with the process.

The installation shall be arranged so that it can be heat traced and thermal insulation applied.

All indicating instruments which includes transmitters with indicators to be located between 1-1,8 m above deck level.

Direct mounted instruments shall be used whenever applicable.

Impulse tubing shall be as short as possible and be installed so that gas/liquid pockets are avoided. Instruments shall be installed below tapping point for liquid service and above tapping point for gas service.

For some installations use of direct flange mounted capillary tubing is specified. The capillary will be fixed to the instrument and flange by the manufacturer.

Impulse tubing shall have minimum 1:12 slope.

7.3 Tubing installation

Instrument tubing shall be supported to field trays or cable ladders for tubing sizes less than 16 mm outside diameter. Cable tray, ladder or equal to be used for larger sizes when mechanical protection is required. Trays are not required for internal tubing on components if tubing is sufficiently protected.
Tubing to be fastened to self drained tubing clamps with span max every 60 x tubing diameter.

Tubing sizes above 25 mm outside diameter shall as a minimum have support every 1.5 m.

Tubing clamps shall be made of non-corrosive material, stainless steel AISI 316 and/or flame retardant plastic.

Galvanic corrosion between tubing and tubing support system shall be avoided. The tubing clamp shall, when installed, not allow for water/sea water to be accumulated between tubing and tubingclamp on wall, this is to avoid crevice corrosion.

Parallel runs of tubing on the same support shall be arranged such that it is possible to have access to every connection point.

Installation into or through panels shall be by use of bulkhead unions or multi cable transits.

Instrument tubing and cables may be installed on the same field tray for shorter distances (appr. 5 m). Instrument tubing and cables may be routed through the same cable/tubing penetration provided the transit is approved for such use.

All tubing and/or tube fittings which are not connected shall be sealed by use of end-plug / cap of some material as the tubing, fittings.

Vent, drain and manifold valves shall be available outside insulation for test connections. Tubing shall be installed to reach outside insulation for test connections.

Capillaries of filled systems shall be continuously supported Spare capillaries shall be coiled inside a cable tray or have similar mechanical protection.

All tubing shall be deburred and blown through with clean, dry air before final installation.

All compression tube fittings shall be of the same make.

The installation shall be done by skilled personnel being familiar with the requirements from the compression fitting supplier.

All tubing in hydraulic systems shall be hot oil flushed and cleaned

Sealing compounds for process services, instrument air services and hydraulic oil services shall be used in accordance with supplier recommendations.

8 TELECOMMUNICATION

8.1 Public address and alarm system (PA)

Public Address and Alarm System equipment should be located above deck level as follows:

- Loudspeakers, 2000-3000 mm.
- PA flashing lights, maximum 3000 mm.

Loudspeakers shall not be located above suspended ceilings or behind obstructions, which will hinder free space sound distribution.

Loudspeakers shall be installed to allow for future adjustments as follows:

- At the horizontal plane, 180 ° deg.
- Downwards 90 °deg. from the vertical plane.

8.2 Telephone system (PABX)

Telephone system equipment shall be located above deck level as following:

- Flashing lights, maximum 3000 mm.
- Telephones approximately 1400 mm.
- Acoustic hoods minimum 2100 mm to top of hood.

8.3 CCTV equipment

To prevent vibrations, camera brackets shall be made sufficiently rigid to provide appropriate stability in all directions.

9 CABLING

9.1 Cable requirements

Cables should comply with NEK 606, Cables for offshore installations Halogen-free or mud resistant.

All cables used shall be minimum flame retardant. Fire resistant cables shall be used whenever required.

Mud resistant cables shall be used where cables are routed into or through areas exposed to mud/oil.

Multicore cables with collective screen shall be standard, individual screens shall be used only when required.

The following systems shall have separate multicore cables:
- General instrumentation
- Fire and gas.
- ESD.
- Telecommunication.

Cable without armour may be used in the accommodation part of the living quarter, offices and control rooms.

9.2 Cable Systems

9.2.1 Cable Segregation

The Cable Network shall be separated into:
System 1 High voltage systems (above 1000V)
System 2 Low voltage power supply and control cables for electrical systems (1000V and below)
System 3 Instrumentation and Telecommunication systems
Cable ladders installed horizontally shall have sufficient space to facilitate cable pulling and cleating/strapping, minimum 300 mm free space between top of one ladderedge to bottom of next ladder edge, and from top ladder edge to roof.

Instrumentation and telecommunication cables may be routed on system 2 cable support systems when minimum 300mm distance between the individual systems are kept.

System 2 and system 3 cables can be installed on same field tray from branch to single equipment when this is not in conflict with the type of signals in the cable.

Crossing at right angels is acceptable without further segregation.

Considerations must be taken during installations of cables entering and leaving field type of equipment like smaler pacages, minor modules, crane pedestals etc. related to segregations as listed above.

Non IS and IS instrument cables should be routed on the same cable ladders/trays. If routed on same ladder/tray, the IS and Non-IS cables, which contain both armour and screen can be tied together in same bundle.

9.2.2 Cable routing

All cables should be routed on cable ladders and trays.

Trunking or conduits may be used for special mechanical protection of single field routed cables for shorter distances. (Approx. 5m.) Where conduits are used, they shall be installed with open ends.

A computer based cable routing system reflecting the layout of the main cable support system (i.e. cable ladders with width 300 mm and above) represented by ladder segment references, transit numbers etc. and necessary describing information related to the individual cable including its route, shall be used in the design.

Field cables may utilize the main cable support system provided the route of the individual cable is being registered in the routing system and the filling and loading of the main cable support system is acceptable.

The cable ladders should not be filled so the height of the cable ladder side rail is exceeded.

Redundant cable systems shall be routed separately as shown on fig.1 room N1.

Field routing inside rooms in safe locations may be on same cable rack/ladder if this is not in conflict with the redundant coverage of the area as shown on fig.1 room N2.

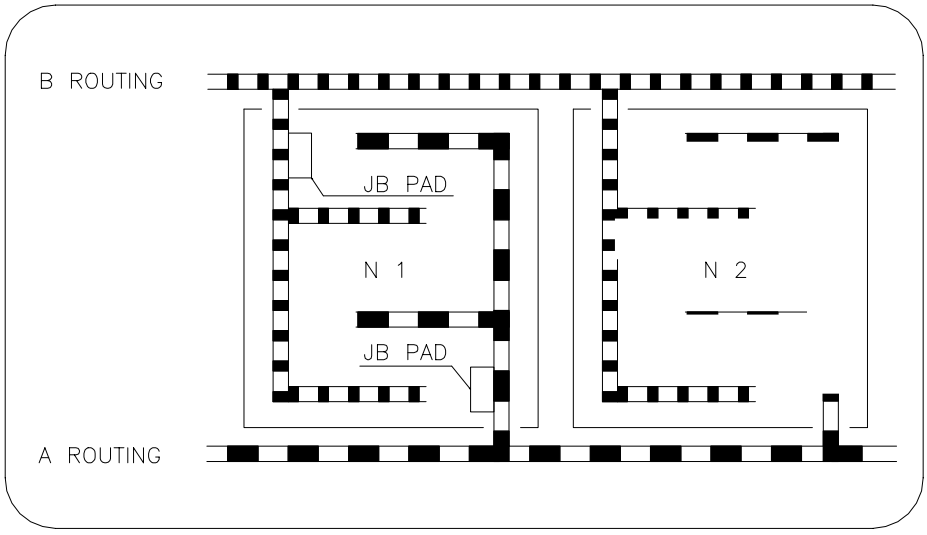

Figure 1 Redundant cable routing.

9.3 Cable installation

Access for maintenance and an orderly layout shall be ensured when cabling below raised floor is performed.

Once a cable has been cut, a protective cap/sealing shall be applied on the end, when being exposed to humid atmosphere.

All cable entries to equipment located outdoors and in wash down areas should be from below. Top entry is not allowed and side entry shall be provided with drip nose.

Sufficient cable spare length shall be provided for equipment which needs future adjustments (floodlights, loudspeakers, etc.) or where equipment have to be dismounted for maintenance and calibration without disconnecting the cable.

Single core cables for three-phase AC shall run in trefoil formation. The braided armour shall be earthed in one end. For equipment installed in hazardous areas, the braid shall be earthed at the hazardous end. When using single core cables, additional cables for earthing have to be installed.

Single core cables shall not be installed separately through openings surrounded by magnetic materials. Non-magnetic stainless steel separation walls and stay plates shall be used in multi cable transits utilised for single core cables.

9.4 Cable bending radius

The minimum permissible bending radius specified by supplier shall be adhered to.

9.5 Cable cleating and strapping

9.5.1 General

Stainless steel AISI 316 straps shall be used for all runs outside and in non ventilated areas.

Ultra violet resistant plastic straps may be used for horizontal runs indoor.

Stainless steel AISI 316 straps shall be used for vertical runs and for horizontal runs in the vertical plane both indoor and outdoor. For strapping of fiber-optical and coaxial cables, supplier guidelines shall be adhered to.

The distance between cable straps shall not exceed:

- 600 mm for horizontal runs.
- 300 mm for vertical runs and for horizontal runs in the vertical plane.
- Ten times the cable outer diameter from cable entry to the first strap.

9.5.2 Single core cables

Trefoil Cable cleats for single core power cables shall be approved for the potential short circuit stress. The cleats shall outdoors, in naturally ventilated areas and wash down areas is made of stainless steel AISI 316.

The distance between trefoil cleats for single core cables shall be as specified by the cable manufacturer based on the calculated short circuit level. The distance shall be selected such that cable will not be damaged by a possible short circuit. Normal distance is 30 cm, and on every step on bends and risers.

9.6 Cable splicing

Cable splicing should be avoided.
Any splicing to be agreed with the company for the installation in question.

9.7 Temporary cables

Temporary cables routed on permanent cable support systems shall be installed such that they will not obstruct permanent installations and are easy to remove.

Temporary cables should not be pulled through multi cable transits intended for permanent cables.

9.8 Cable glands selection

Cable glands/blanking and drain plugs shall be selected as follows:

Plastic enclosures (relevant for field cables)	plastic for sizes below M32
Plastic enclosures, reinforced with a metal gland plate for support of large supply- and multi core cables	brass
Metal enclosures (except aluminium)	brass / stainless steel (AISI 316)
Aluminium enclosures	stainless steel /nickel plated brass

The certifications of the cable glands/blanking/and drain plugs shall comply with the certification of the equipment in which the glands/plugs are connected.

Ex d gland only to be used on Ex d direct entry equipment.

9.9 Cable termination

9.9.1 Cable make-off

Cables with braid armour shall have outer heat shrink sleeve, which is fitted over the complete cable make-off.

Instrument and telecommunication cables with both braid armour and screen shall have inner and outer heat shrink sleeves:

- The inner sleeve shall be drawn over the inner bedding, i.e. passed under the braiding providing insulation between braiding and screen.
- The outer sleeve shall be fitted over the complete cable make-off.
- The inner sleeve may be excluded at termination's providing a minimum of 50 mm inner bedding.

To minimise the extent of hot work sleeves of type self vulcanising-tape may be used on units in operation.

9.9.2 Termination

High voltage cables should be fitted with insulated connectors at transformers and consumers end and voltage stress cones or similar stress relieving device at feeder's end.

All cable conductors shall be terminated by use of compression lugs or ferrules dependent upon the type of termination. The compression ferrule should be the type where the conductor strands are inserted through the whole ferrule and reach the bottom of the terminal.

Support for cleating of cables when entering panels should be provided.

In switchboards and distribution boards adequate space shall be provided for the use of a clip-on amperemeter without causing undue stress on the cable conductors or connections.

The braid armour and the screen shall be separated from each other as well as from the conductors, twisted and fitted as required. This shall be done without any reduction of the cross sectional area.

Where the screen shall be left disconnected (applicable for field instrument), it shall be sealed and isolated with an isolating cap, which allows for insulation testing without any disconnecting.

Only one conductor is allowed in each terminal of a terminal block/row for external connections. This is not related to terminals as integrated part of internal components (e.g. relays, contactors) of the equipment. Two conductors may in certain cases be used in one approved type ferrule connected to one terminal.

9.10 Spare conductors

Spare conductors in instrument and telecom cables shall be terminated and left floating at the field end.

In cabinets all spare conductors shall be marked with terminal number and connected to terminals linked together by solid terminal links, which shall be connected to the relevant earth bar.

Spare cores in instrument and telecom cables shall be connected to IE earth in supply end only.

If there are no spare terminals left in the cabinet, all spare conductors shall be covered with yellow / green sleeves and marked with relevant cable number and connected directly to the relevant earth bar.

10 EARTHING

10.1 General

The installation shall comply with "Retningslinjer for jording i maritime anlegg" published by Eltilsynet (Norwegian Directorate for Product and Electrical Safety).

Exception: Field equipment shall be earthed through the supply cable.

Earth bars shall be located in front of panels and junction boxes to allow easy access for usage, inspection and maintenance.

10.2 Main earth reference

The Main earth reference for all earthing systems shall be the main structure.

If aluminium is used for any part of the main structure attention shall be given to ensure that continuity in the structural earth is maintained at aluminium/steel interface points.

The Main earth reference points shall be earth bosses welded to the structure as close as possible to the cabinet / equipment. Alternatively, earth bars mounted on earth bosses welded to structure may be used.

There shall be a separate Main earth reference point for PE and IE.

The distance between the PE and IE Reference points shall be minimum 1000 mm.

10.2 Protective earth

Field equipment shall be connected to the PE system through the cable. The braid armour shall be the earth conductor and it shall be electrically continuous from the field to the central equipment PE bar.

For power cables where the braid armour does not have sufficient cross section, the equipment shall be earthed through a separate earthing conductor in the cable.

Equipment supplied by single core cables shall be connected to PE by a separate earthcable. The separate earth cable shall run alongside the power cables to form a "cable system" and be terminated to the field equipment earth terminal as well as feeding end earth bar/terminal.

The copper braid of the single core cables shall be earthed at one end, isolated in the other end. Where hazardous areas are involved, the copper braid shall be earthed in the hazardous area.

Ex d electrical equipment with direct entry, shall be connected to the PE system by a separate earth conductor in the cable.

The PE earth cables or braids armour of cables, connected to a switchgear, cabinet, equipment etc., to be connected to a PE earth bar as close as possible to the cable entry of the switchgear, cabinet, equipment.
The PE earth bar to be easy accessible

10.3 Instrumentation and telecommunication earth

The IE shall be the earth reference for non intrinsically safe, intrinsically safe instrumentation and telecommunication 0 volt references etc.

The IE screen shall be left floating in the field end. It shall be electrically continuous from the field equipment and be connected to IE bar in the central cabinet.

The screen shall be connected to one IE bar only for signal cables between two control cabinets.

10.4 Bonding

Exposed conductive parts located in hazardous- and mechanical ventilated areas shall be bonded to the main structure.

Bonding shall be provided between the platform structure and all preassemblies, modules and decks that are not welded or bolted together.

Separate bonding shall only be applied for equipment, which is isolated from main structure.

Enclosures of high voltage equipment located in hazardous areas shall be connected to PE and bonded to the main structure.

10.5 Earth bar and earth boss

10.5.1 Earth bar

Earth bars shall be fabricated from copper and provided to suit number and size of connections.

PE bars shall be connected to the nearest convenient main structure point through an insulated earth conductor or through the supply/feeder cable.

IE Bars shall be isolated from the enclosure and connected to the nearest convenient main structure point through an insulated earth conductor.

10.5.2 Earth boss

Where earth bosses are used, each earth boss shall only have one connection. After connection, the whole assembly shall be sealed in accordance with the NORSOK standard M-501 Surface preparation and protective coating. Bonding bosses in outdoor and exposed areas to be coated to prevent corrosion.

11 SUPPORT SYSTEM

11.1 Cable support system

Maximum distance between the supports shall be as specified by supplier. Typical support distance is every 3m.

Cable ladders installed horizontally shall have sufficient space to facilitate cable pulling and fixing, minimum 300 mm free space on top of ladder.

All surfaces shall be cleaned prior to bolting together.

Cable support systems shall be located to leave sufficient space for surface protection of adjacent structure.

In offices and living quarters where multidiscipline socket outlets are grouped together, multipurpose cable channels designed for recessed installed outlets should be used.

11.2 Kick plate / protection shield

Kick plate shall be fitted around penetrations in floor where cables/tubing are exposed to mechanical damages.

Protection shield shall be installed where cables can be exposed to physical damages, minimum 500 mm above the floor.

11.3 Equipment brackets and supports

Equipment brackets and supports should not be installed on removable deck, grating, panels, handrails, pipes or other removable equipment.

12 MARKING AND LABELLING

12.1 General

All marking shall be in accordance with the NORSOK standard, Coding system, Z-DP-002.
All electrical equipment shall be marked with function, supply panel and circuit/cubicle.

12.2 Cable ladders

Cable ladder segments and MCT's shall be marked with system and segment number.

High voltage cable ladders, shall be marked with warning labels in accordance with the national regulations.

12.3 Equipment

Internal in serial produced equipment with power electronics i.e. like UPS, ASDS, and supplier's standard for internal wiring and marking shall be accepted.

All labels shall be fabricated and installed in accordance with the following requirements:

- Labels shall be readable from deck or access platform . Labelsizes to be sized accordingly.
- Labels should not be mounted on removable parts.
- Labels should be fixed by AISI 316 screws, rivets or suitable glue (only in dry areas).
- Separate label brackets, if used, shall be made of AISI 316.
- Labels shall be of engraved traffolyte, marked as follows:
    - Black letters on white background, letter size 10-20 mm.
    Electrical, instrumentation and telecommunication systems.
    (service description in Norwegian)
    - White letters on red background, letter size 10-20 mm.
    Instrument ESD systems, Fire & Gas systems and warning labels.
    (service description in Norwegian and English language)

In panels fuses shall be clearly marked. A fuse list shall be provided inside of panel.

All emergency lighting fixtures with integral batteries shall in addition to normal labeling be marked to identify that integral batteries are present and to identify which light source is battery backed.

Warning labels shall be in accordance with national regulations.

12.4 Tubing for air and hydraulic supply

Supply tubing shall be marked with consumer tag-number at the distribution manifold or at hook-up to main line.

When tubing enters through bulkheads/penetrations, tubing shall be marked with tag no. on both,sides of the bulkhead/penetrations.

12.5 Cabling

12.5.1 Cables

Each cable shall be marked with indelible and non-corrosive cable markers indicating the cable number. The cable markers shall be clearly visible after cleating and strapping. Outdoors, in exposed- and wash down areas the cable markers shall be of stainless steel markers.

Each cable shall have a cable marker located:

- At both side of multi cable transits.
- At both ends.
- Outside cabinets with gland / MCT entries.
- Inside cabinets with open entries.

Heat tracing cables shall be marked:

- On the cable loop inside the junction box.
- Warning labels indicating the legend "Heat Tracing Cable" shall be fitted to the thermal insulation covers as required, at maximum distance 5 metres.
- Warning labels indicating " Heat tracing splice" and "Heat tracing end seal" shall be fitted to the thermal insulation covers above splices and end seals.

12.5.2 Identification of busbars, conductors and wires

Individual conductors and wires shall be identified with a closed, slip-on type plastic cable identification ferrule, carrying a number identical to the terminal. This is also applicable to the single conductors for cross wiring between the terminal blocks in panels.

Busbars, conductors and earth wires shall be coded as following:

AC systems:

Phase 1	L1	Black
Phase 2	L2	White
Phase 3	L3	Red
Neutral	N	Blue
Protective Earth	PE	Yellow/Green
Protective Earth / Neutral	PEN	Yellow/Green + Blue

Conductors in single phase cables, from distribution boards in three phase four wire system (3ph + N), can, inside light fixtures, socket outlets, junction boxes etc., have conductor color as cable core colors (normally black and white). Black always used for the phase.

DC systems:

Positive pole	(+)	Black
Negative pole	(-)	Blue (White)

12.5.3 Color coding of earth conductors, earth bars and cables screen.

12.5.3.1 Protective earth (PE)

Earth conductors shall be colored yellow / green.

The braid armour shall be covered with sleeves, colored yellow / green.

PE bars shall be marked yellow / green.

12.5.3.2 Instrument earth (IE)

The IE screen shall be covered with sleeves, colored yellow / green:

- IE bars shall be marked yellow / green and with:A red mark for bars containing non-IS cables only.
- A blue mark for bars containing IS cables only.
- Both red and blue mark containing non-IS and IS cables.

12.5.3.3 Bonding

Static earth conductors shall be colored yellow / green.

13 MATERIALS

13.1 Equipment materials

All equipment and materials shall minimum be flame retardantand with low halogen content.

Equipment enclosures located outdoor, in naturally ventilated areas and wash down areas, shall be made of proven sea water resistant material or protected by a coating system according to NORSOK Standard M-501, surface preparation and protective coating.

Electrical/electronic equipment in panels shall be protected against hydraulic leakage.

13.2 Junction boxes

Junction boxes should be made of glassfibre reinforced plastic with polyester resin. In outdoor areas exposed to changing environmental conditions stainless steel AISI 316 may be used.

When junction boxes are installed in exposed areas, drain plugs shall be installed. Anti condensation heating should be provided in boxes containing active components.

Junction boxes shall be designed with sufficient space for the expected number of cables and cable make-off's.

13.3 Cable support systems

Cable support systems located outdoors, in natural ventilated areas and wash down areas shall be made of stainless steel AISI 316 L. For indoor ventilated areas cable support systems made of galvanised carbon steel may be used. Cable supports shall be of same material as the cable rack / tray.
Aluminium cable support system may be used in special selected areas.

Cable protection shields shall be made in the same material as the cable support system in the area.

13.4 Equipment brackets and supports

Equipment brackets and supports should be fabricated from carbon steel hot-dip galvanised in accordance with NORSOK standard M-501, surface preparation and protective coating, or from stainless steel AISI 316L. Equipment brackets shall be fabricated from the same material as the cable support system in the area.

Junction box stands shall be fabricated from the same material as the cable support system in the area.

13.5 Multi cable transits (MCT)

According to cable configuration, the material shall be selected to avoid eddy current.

13.6 Earth bosses

Earth bosses shall be made of stainless steel AISI 316 L.

13.7 Fixing materials

Screws, bolts, nuts and washers shall be made of stainless steel AISI 316 . Star washers shall not be used. On cable racks/trays etc. nuts with integrated washer or manufacturer standard to be used.

13.8 Precautions against galvanic corrosion

Precautions against galvanic corrosion shall be taken whenever contact between dissimilar metals is present.

14 HANDBOOK

14.1 Typical index

Below is a typical index that could be used for a Handbook if that is needed.

1. Index
2. Health Environment and Safety
3. Quality assurance
4. Specifications
5. Welding procedure
6. Numbering system
7. Typical installation drawings
8. Preservation
9. Mechanical Completion
10. Tools, warehouse and transport
11. Quality assurance

ANNEX A - TYPICAL INSTALLATION DRAWINGS (INFORMATIVE)

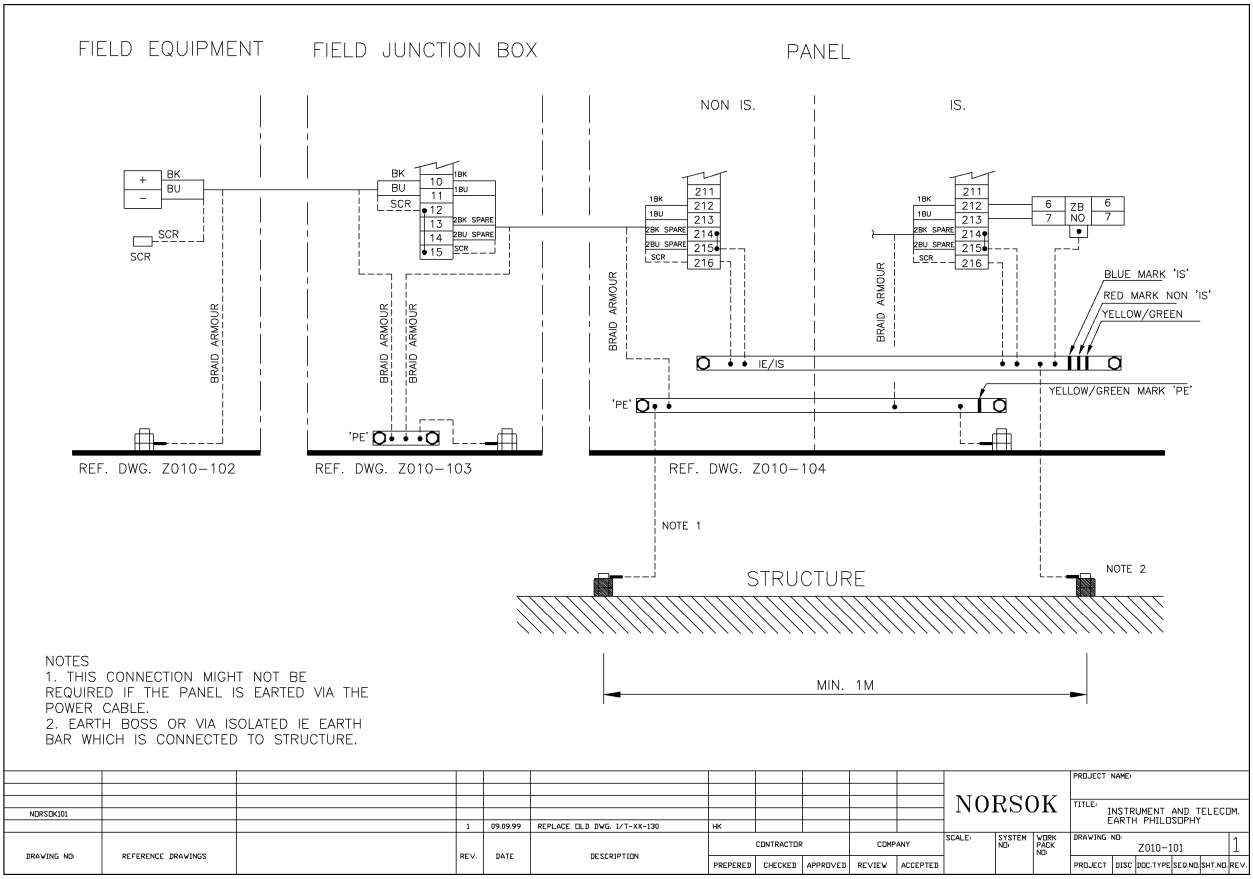

Figure A.1 Instrument and Telecom Earth

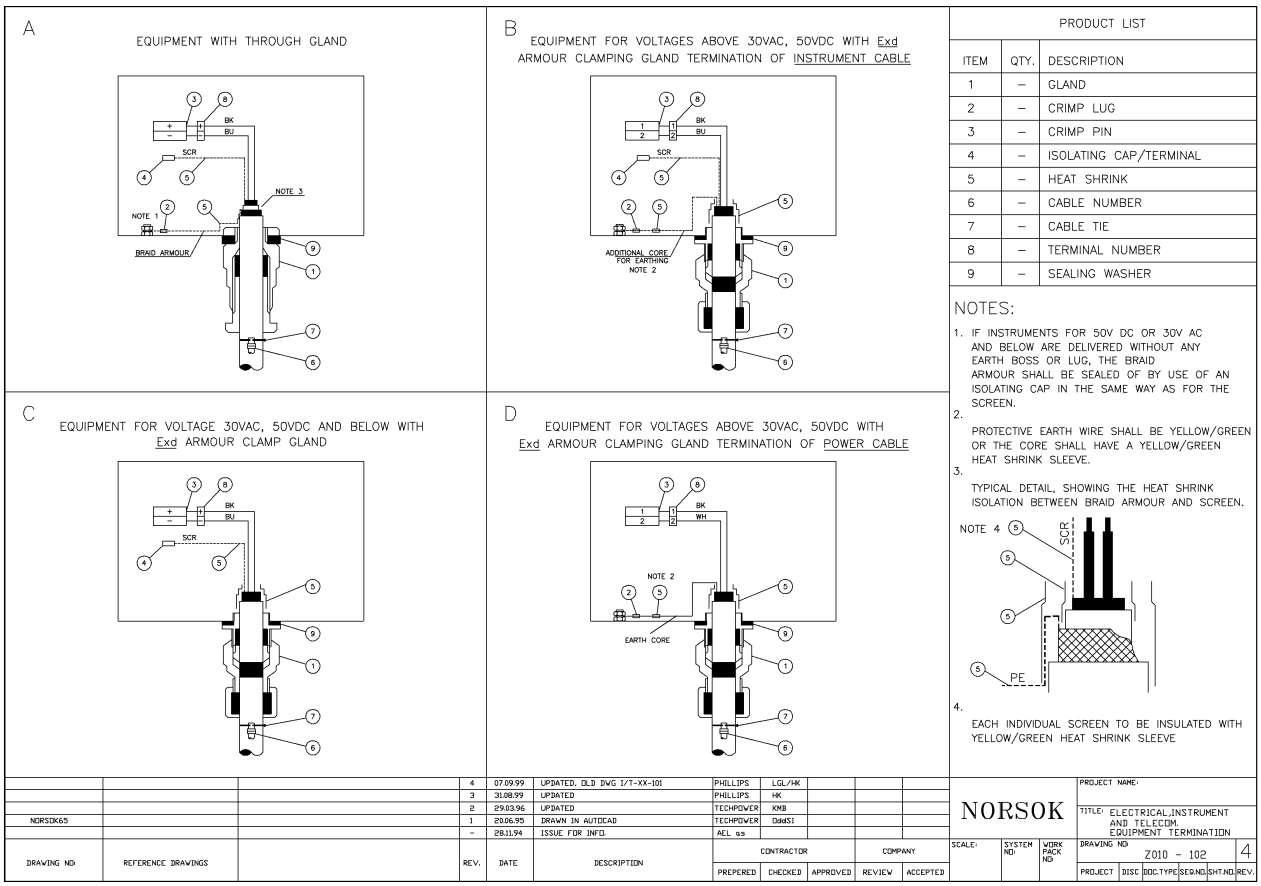

Figure A.2 Electrical, Instrument and Telecom Equipment Termination

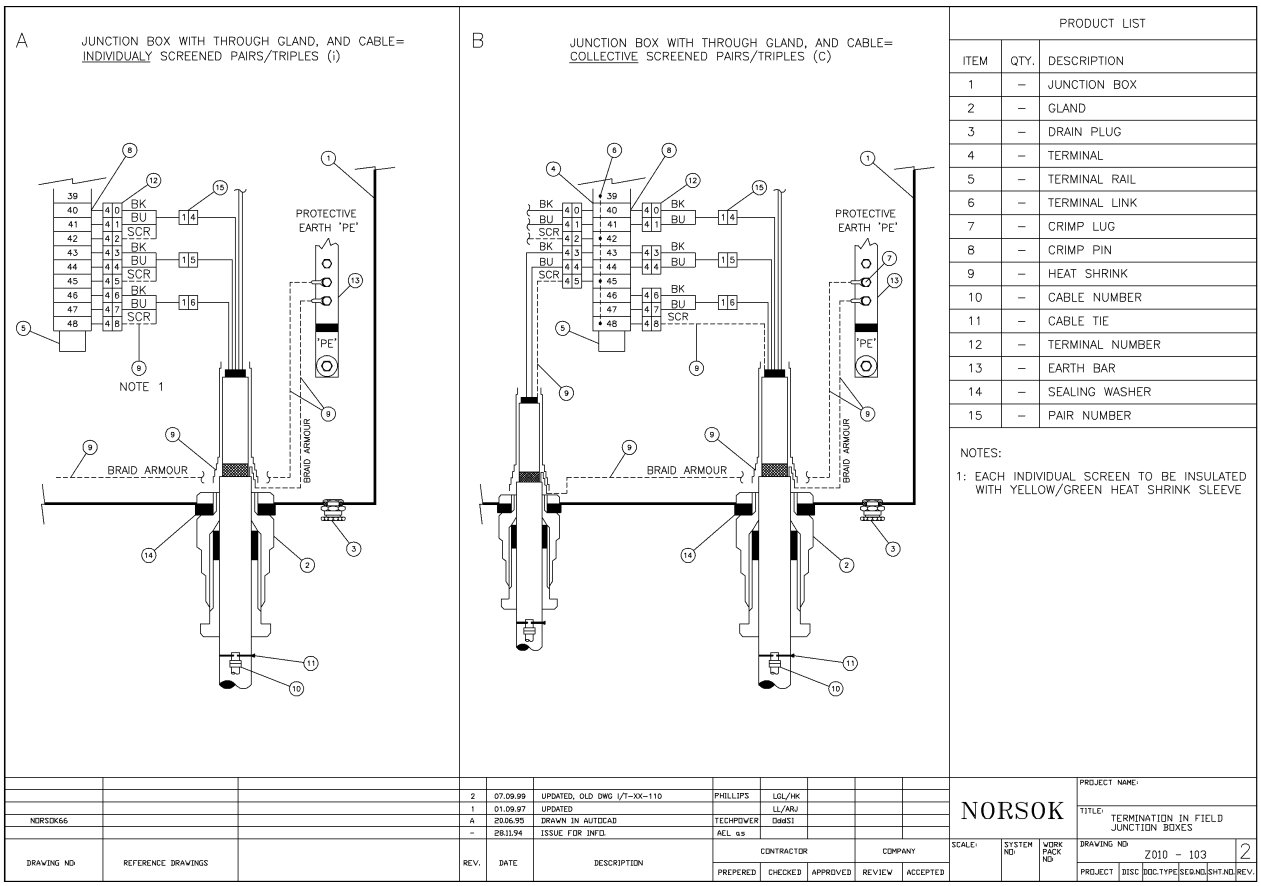

Figure A.3 Termination in Field Junction boxes

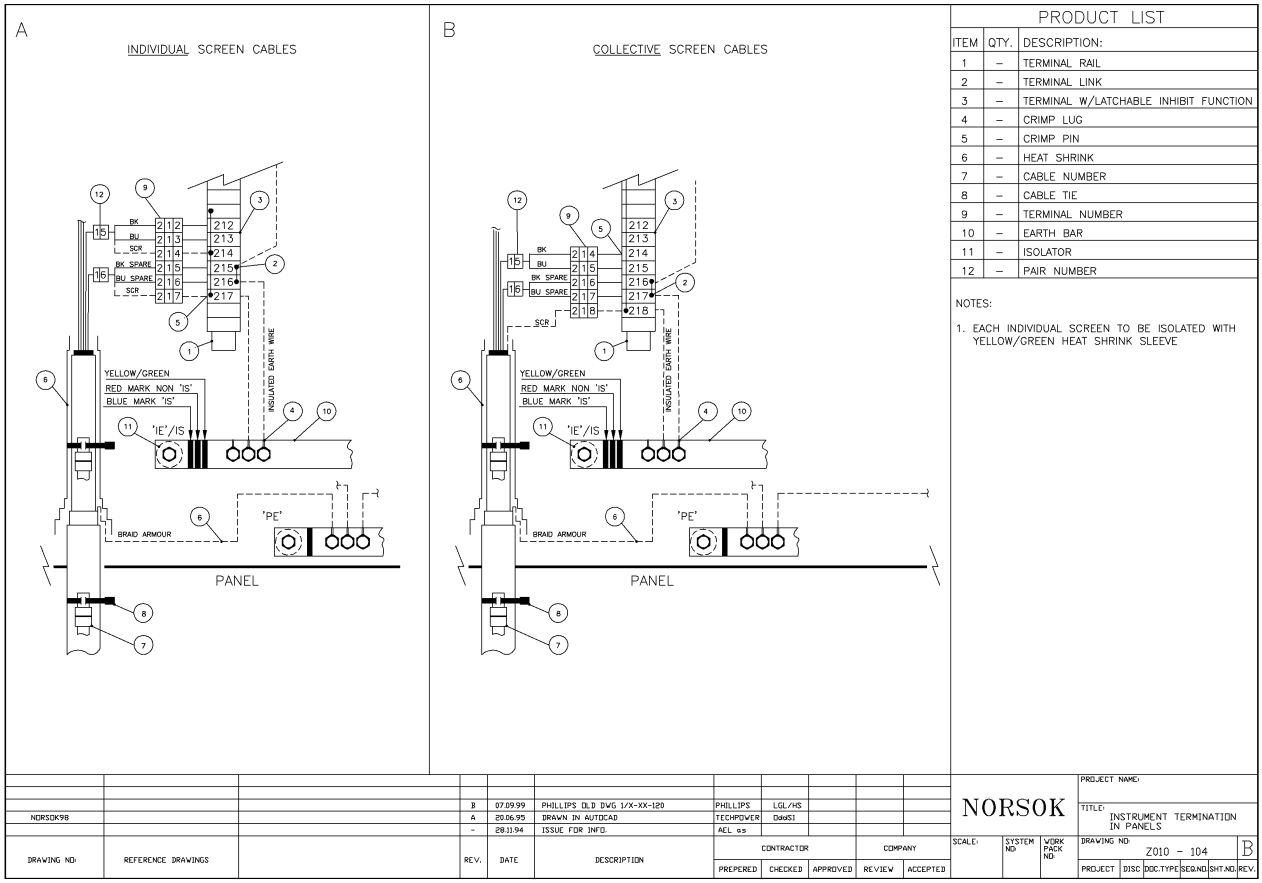

Figure A.4 Instrument Termination in Panels

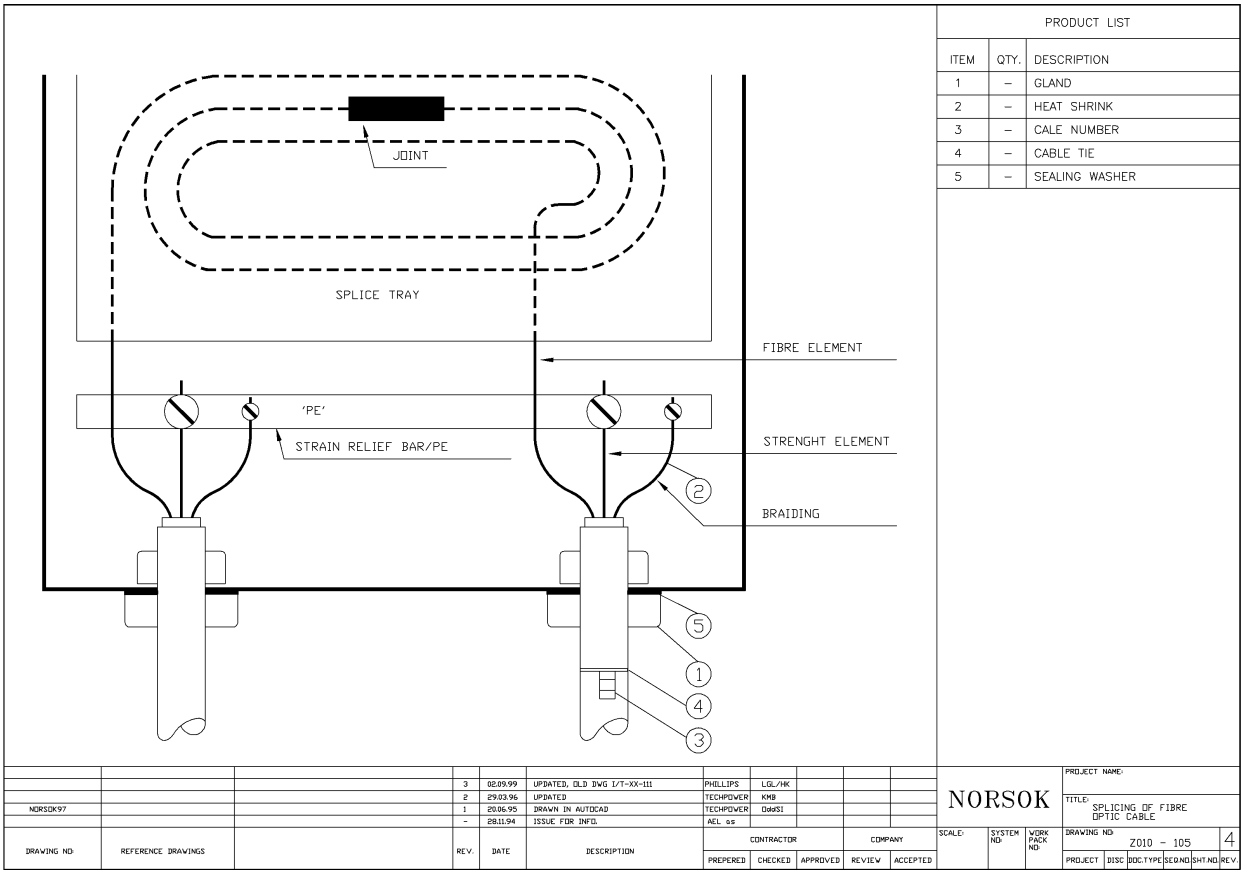

Figure A.5 Splicing of Fiber Optic Cable

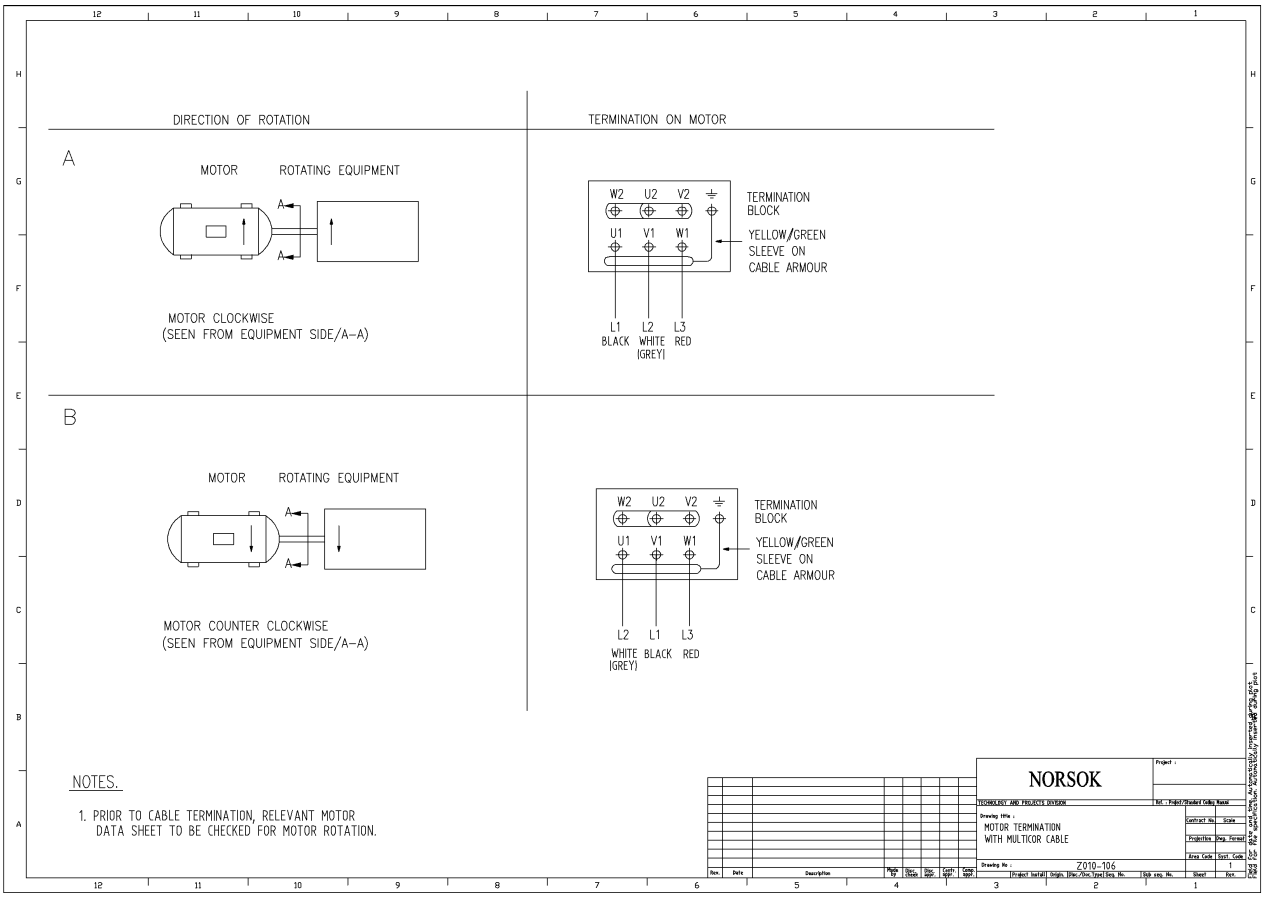

Figure A.6 Motor termination with Multicore cable

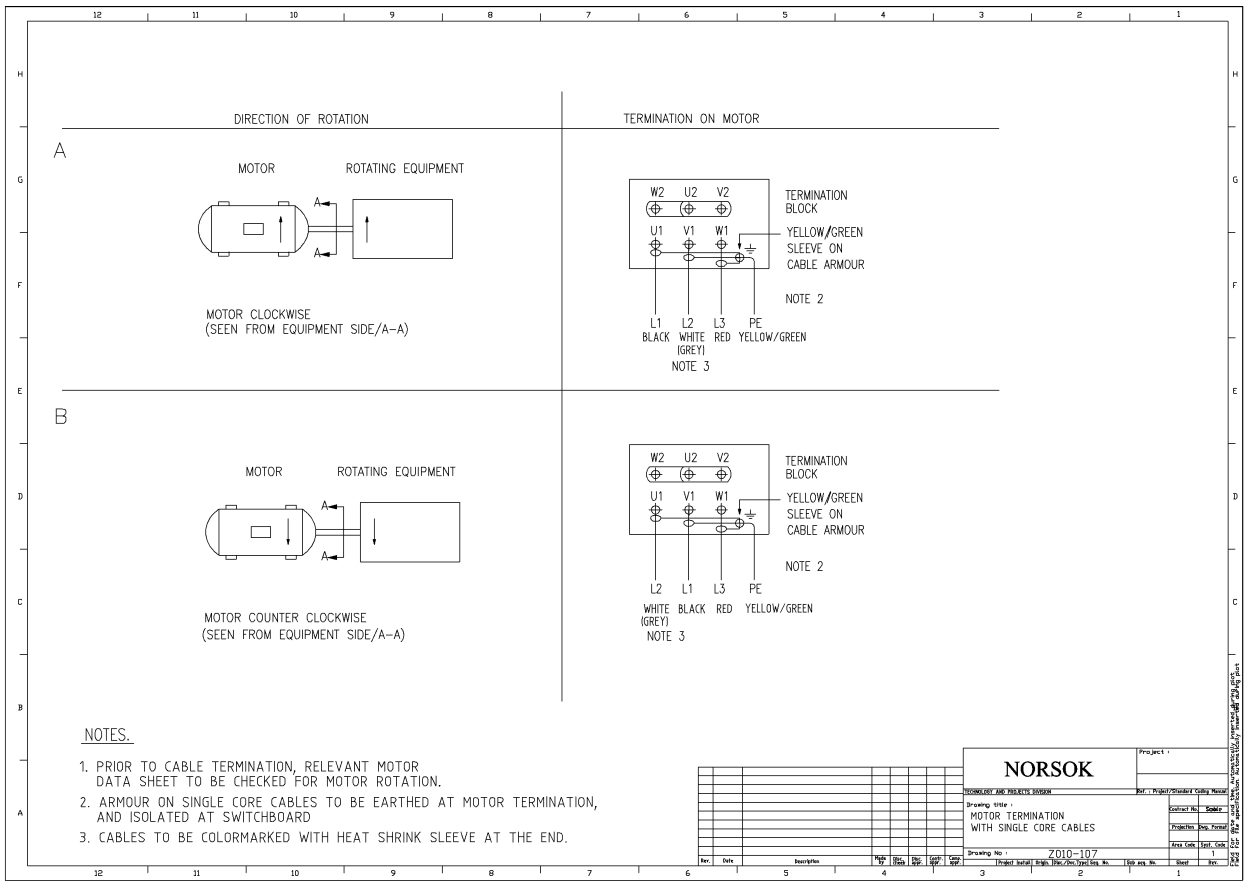

Figure A.7 Motor termination with Single core cable

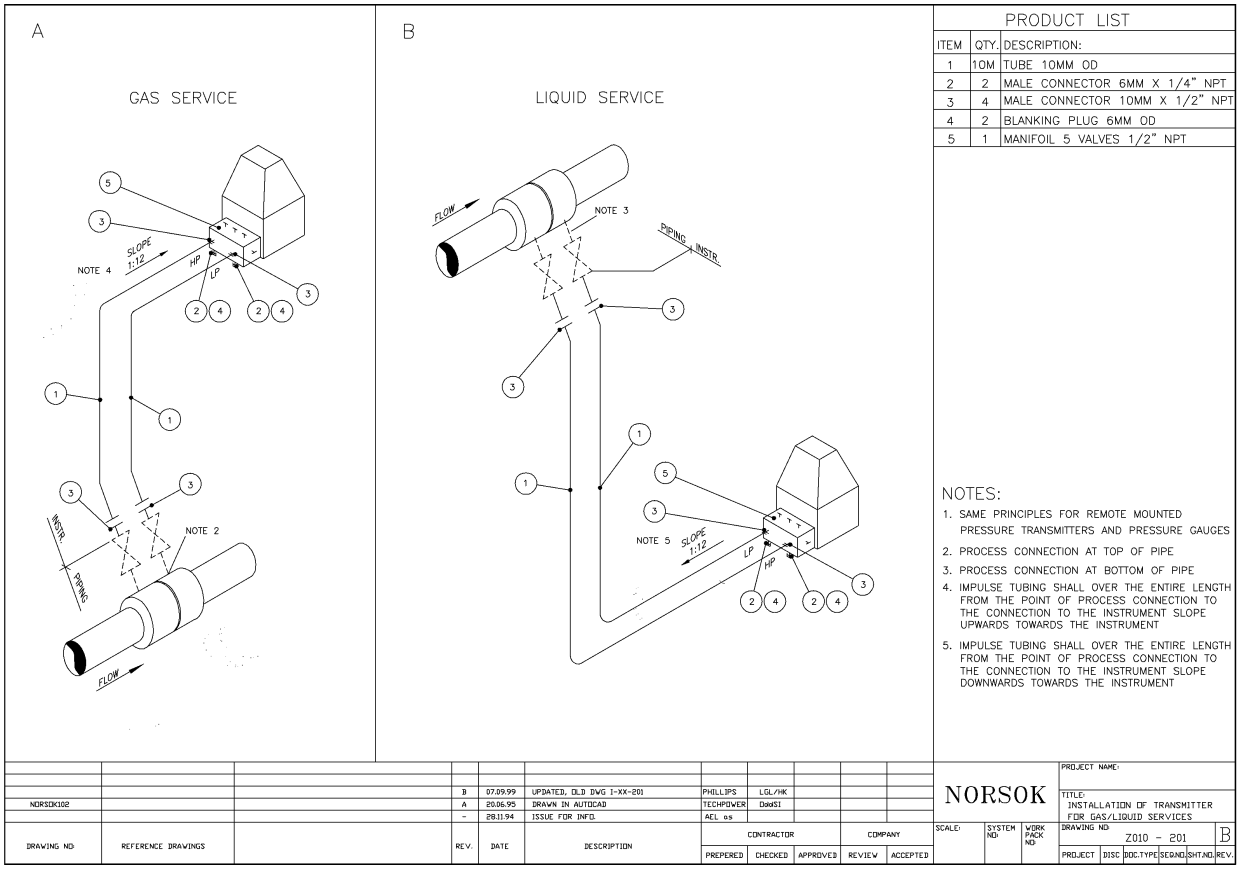

Figure A.8 Installation of Transmitter for Gas/Liquid Services

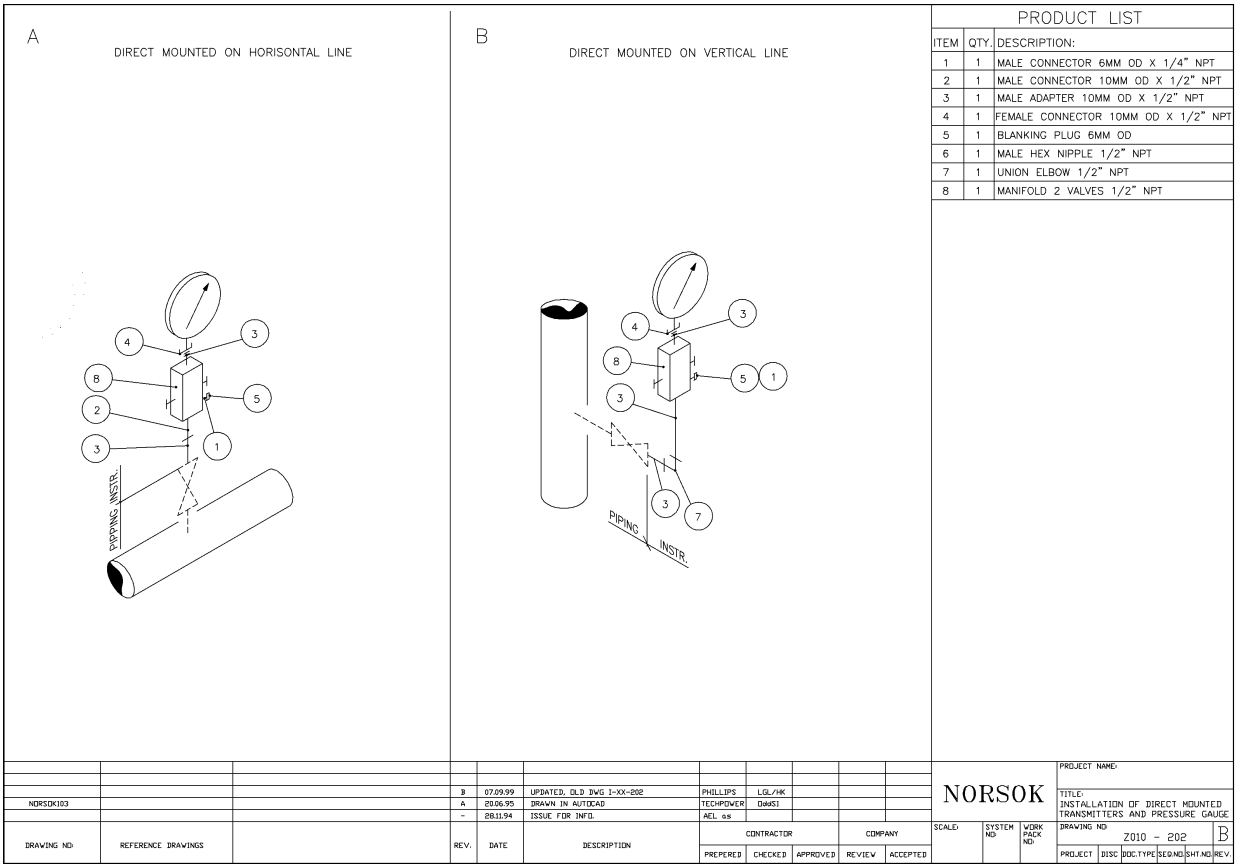

Figure A.9 Installation of Direct Mounted Transmitters and Pressure Gauge.

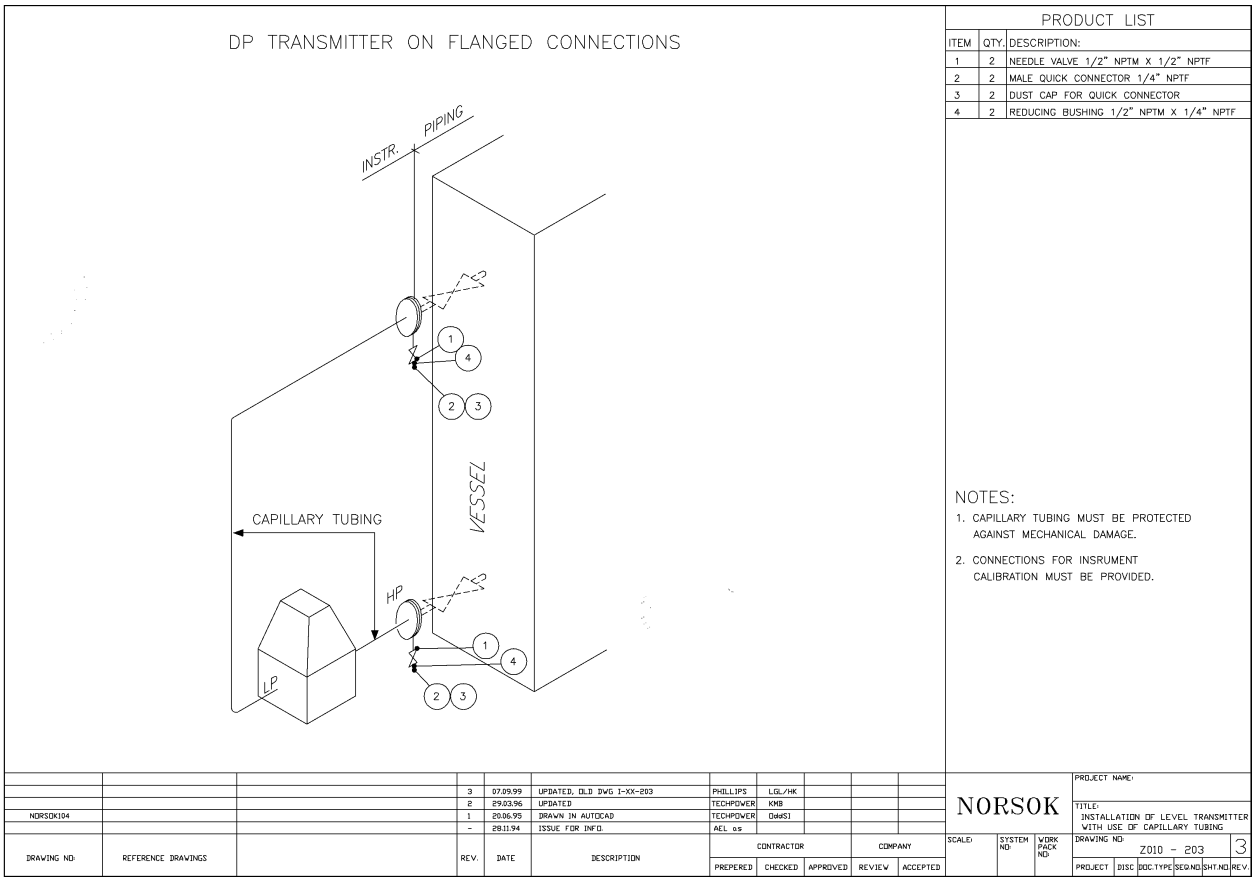

Figure A.10 Installation of Level Transmitter with use of Capillary Tubing.

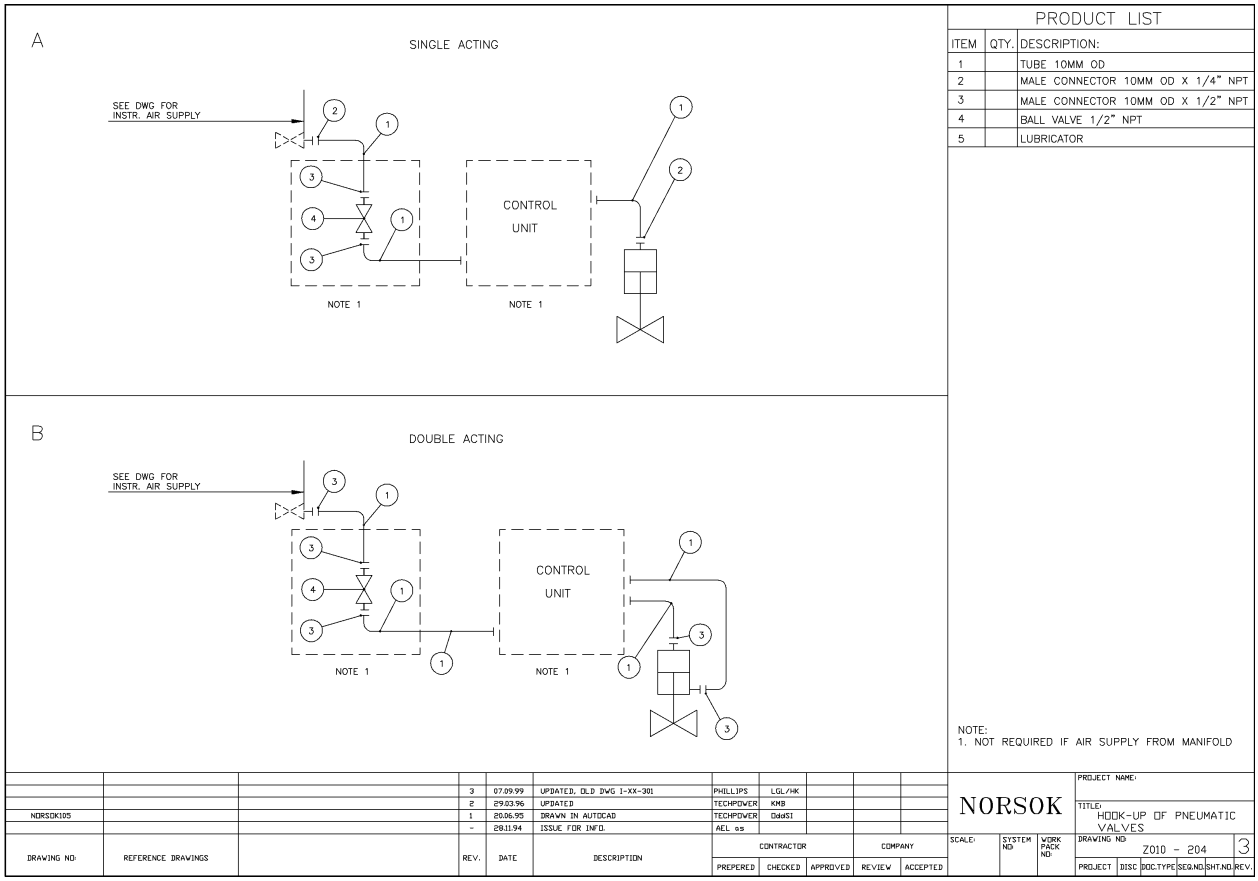

Figure A.11 Hook-up of Pneumatic Valves

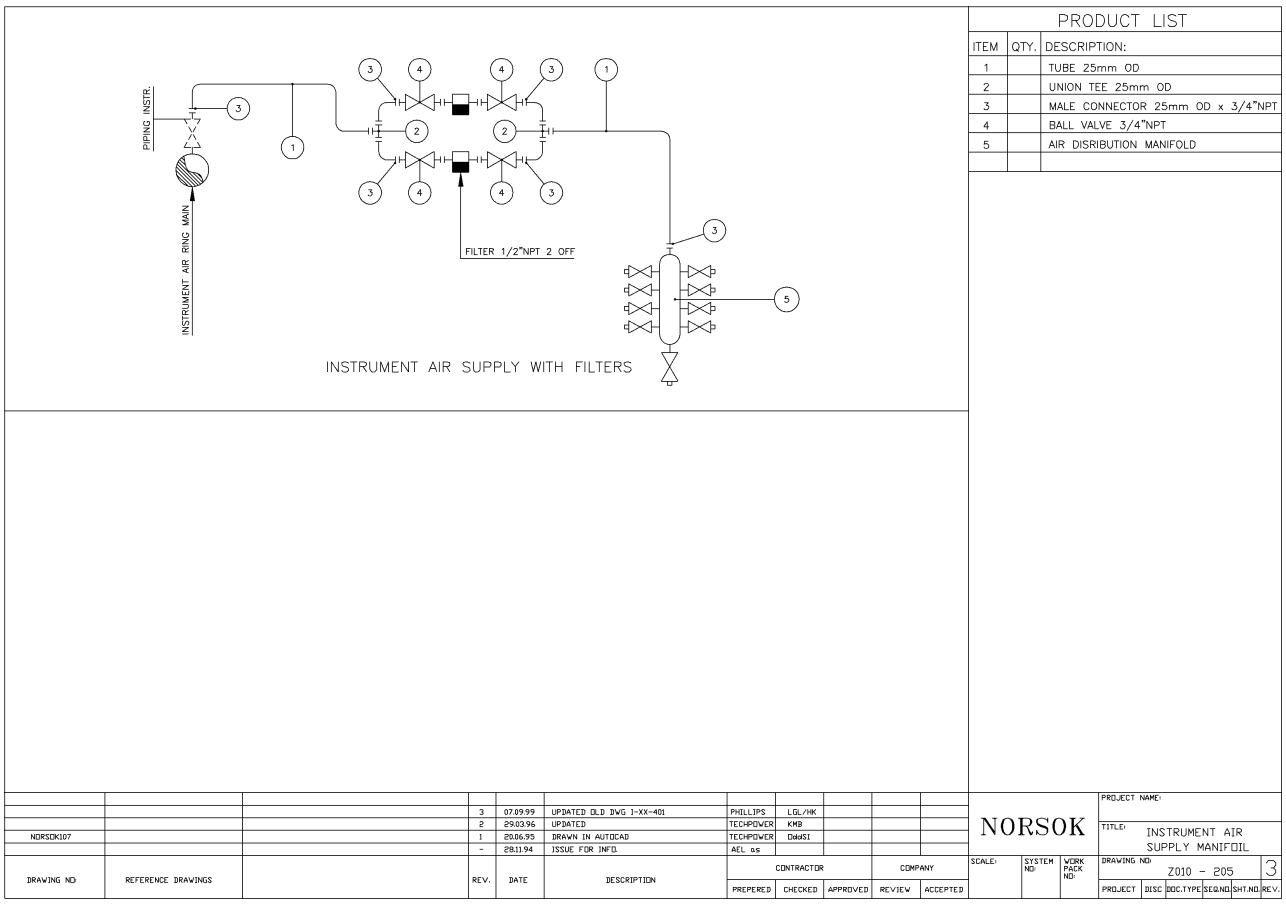

Figure A.12 Instrument Air Supply Manifold

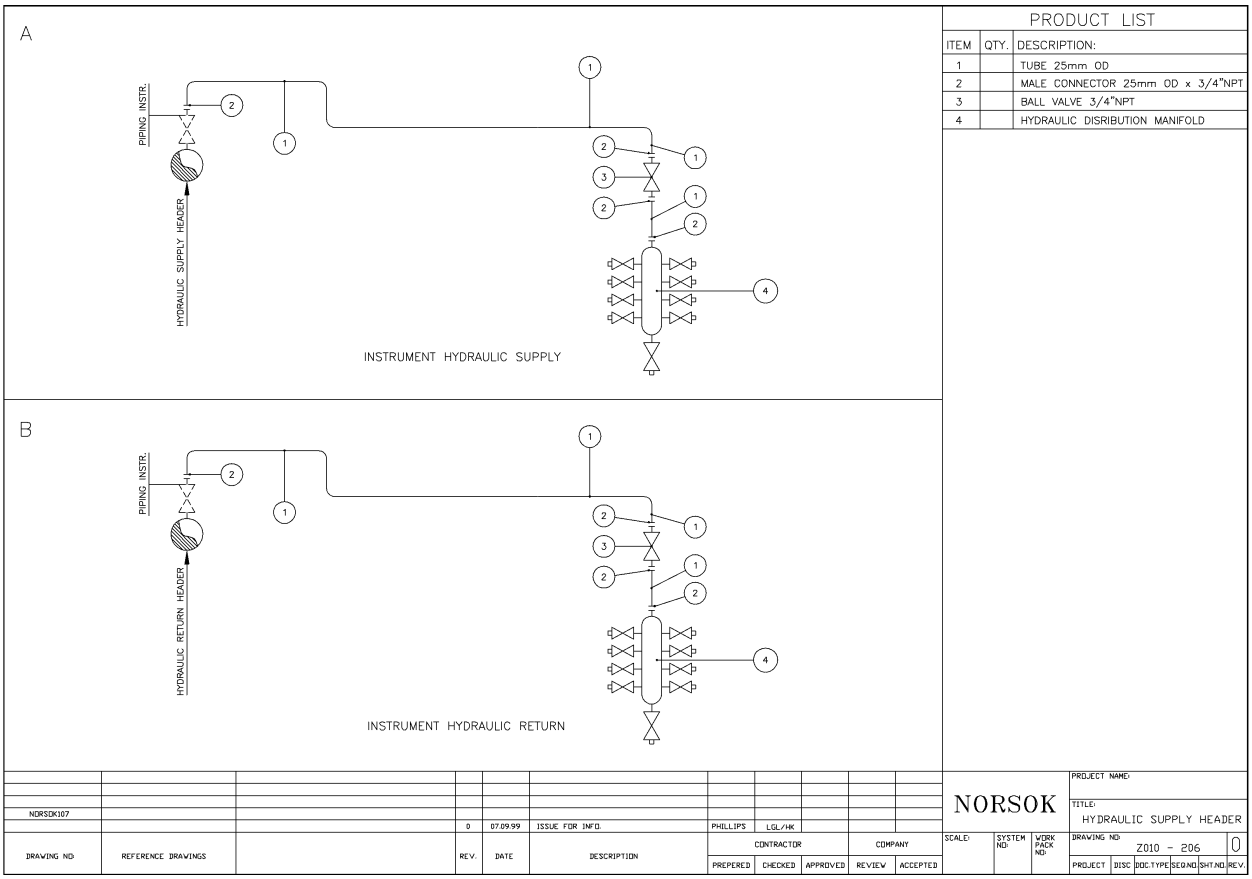

Figure A.13 Hydraulic Supply Header

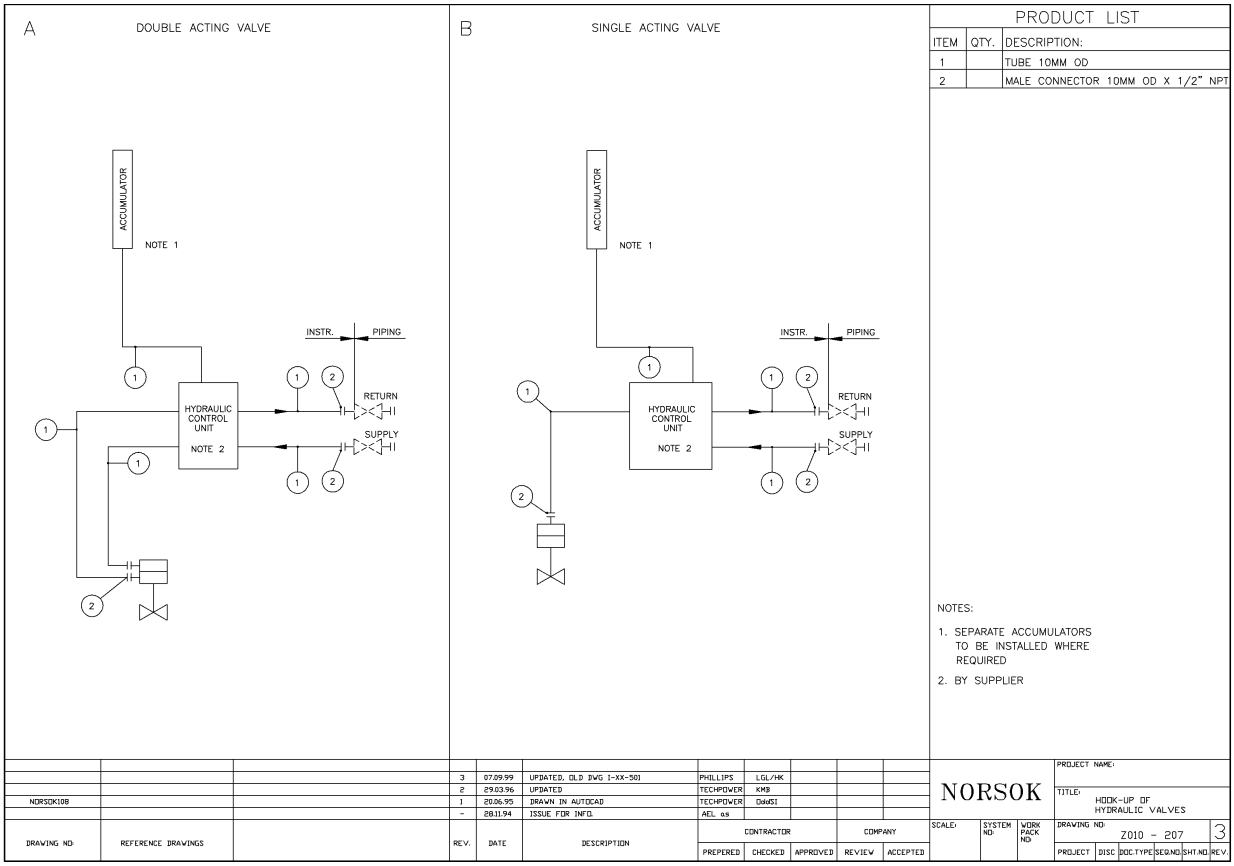

Figure A.14 Hook-up of Hydraulic Valves