

NORSOK STANDARD
COMMON REQUIREMENTS

DOCUMENTATION FOR OPERATION (DFO)

Z-CR-001

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Please note that whilst every effort has been made to ensure the accuracy of the NORSOK standards neither OLF nor TBL or any of their members will assume liability for any use thereof.

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1 FOREWORD

NORSOK (The competitive standing of the Norwegian offshore sector) is the industry initiative to add value, reduce cost and lead time and remove 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 are jointly issued by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Engineering Industries). NORSOK standards are administered by NTS (Norwegian Technology Standards Institution).

The purpose of this industry standard is to replace the individual oil company specifications for use in existing and future petroleum industry developments, subject to the individual company's review and application.

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 Subject to implementation into international standards, this NORSOK standard will be withdrawn.

Annex A is normative. Annex B is informative.

2 SCOPE

This standard defines the extent of technical information which shall be available for use in the operational phase. The main objectives are to ensure that only necessary information is available, to facilitate the safe, effective and rational operation and maintenance of the installation.

3 NORMATIVE REFERENCES

IEC 617	Graphical symbols for diagrams.
ISO 3511	Process Measurement Control Functions and Instrumentation - Symbolic representation (Part I, II, III and IV).
ISO R538	Conventional signs to be used in schemes for the installation of pipeline systems in ships.
NORSOK	Coding system (Z-DP-002)
NS 1710	Technical drawings - Drawing symbols for piping systems.
NS 2130	Offshore Installations, Weight Engineering, Specification for Weighing of major assemblies.
NS 2131	Offshore Installations. Weight Engineering. Specifications for weight data from suppliers and weighing of bulk and equipment.
NS 5820	Supplier documentation of equipment.

4 DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

Normative references	Shall mean normative in the application of NORSOK standards.
Informative references	Shall mean informative in the application of NORSOK standards.
Shall	Shall is an absolute requirement which shall be followed strictly in order to conform with the standard.
Should	Should is a recommendation. Alternative solutions having the same functionality and quality are acceptable.
May	May indicates a course of action that is permissible within the limits of the standard (a permission).
Can	Can requirements are conditional and indicates a possibility open to the user of the standard.
Bulk Component	Unit or item which does not require an individual physical identity. A bulk component shall be identified by manufacturer's name and model/type identification.

Component	Item which does require an individual physical identity. A component shall be identified by manufacturer's name, model/type identification and serial number.
Part	Part is any part of a bulk component/component. Part shall be identified by manufacturer's model/type identification.
Document	A limited amount of information stored on various types of media, e.g. paper, film, magnetical or optical memory.
As Built	Documentation where mark-up information have been formally incorporated into a new revision of the original document according to individual requirements for each project.

4.2 Abbreviations

IDAS	Instrument datasheets.
ISO's	Isometric drawings

5 REQUIRED INFORMATION

5.1 General

Required information is shown in Annex A, "Detailed Requirements". It shall be noted, however, that information supplied shall be limited to information relevant for the installation. Standard documentation will be acceptable when it fulfils this requirement.

Specified documents shall be provided as individual documents, not combined in mutual documents.

All information shall have As-built status and be available in electronic form.

ANNEX A DETAILED REQUIREMENTS (NORMATIVE)

A1 DOCUMENT INDEX

The following information shall be included:

- Document type code.
- Document number. (Document Identification code)
- Originator code.

- File reference. (File name)
- File format. (File type)
- Originators document number.
- Document title.
- Document format.
- Revision code.
- Revision date.
- Status code.
- Area code.
- Discipline code.
- Reference to tag codes.
- Reference to components and bulk components.

NOTE: All coding shall be in accordance with NORSOK standard Z-DP-002, Coding system.

A2 DESIGN AND FABRICATION SPECIFICATIONS

These are design and fabrication specifications specially produced for the development project. (Standard project specifications are not included)

A3 PROJECT DESIGN CRITERIAS, PHILOSOPHIES ETC.

This documentation is only related to design criterias, philosophies and requirements specially produced for the development project.

A4 SYSTEM DESIGN REPORTS AND SYSTEM USER MANUALS

System design reports and system user manuals shall give sufficient details to argue the reason for choice of the design related to system parameters. Typical content shall be:

- System description with reference to drawings.
- Operational data and limitations.
- Composition of medium.
- Material choice.
- Corrosion evaluations.
- Bases for choice and use of corrosion inhibitors.
- Location of injection points.
- Location of sampling points for analyses.
- Location of areas for corrosion control equipment.
- Piping areas and spools with high stresses and need for additional inspection. Reference shall be made to calculations and stress isometrics.
- Inspection requirements for tanks and pressure vessels.

The document may be split into design report and system user manual.

A5 USER MANUAL (EQUIPMENT)

The supplier standard User Manual shall preferably be used, ref. NS 5820. If the supplier does not have a standard User Manual, a User Manual shall be specially prepared according to Annex A of NS 5820.

A6 FABRICATION & VERIFYING DOCUMENTATION

GENERAL

By fabrication and verifying documentation is meant construction, manufacturing, testing, reporting and certification documentation required to demonstrate that constructions, equipment, materials and fabricated systems and units are in compliance with the statutory regulations and specified requirements.

Such documentation shall be prepared as specified in this standard to fulfil user requirements for the operational phase.

CERTIFICATE OF CONFORMANCE

One document shall cover the complete contract/purchase order. The contractor/supplier shall confirm that the requirements in the contract/purchase order for design, calculations, fabrication and testing have been met.

All non conformances shall be stated on the same certificate.

MATERIAL TRACEABILITY, WELD AND NDE DOCUMENTATION

Documentation for operation shall contain typical certificates or a reference to Norsok material datasheet for applied materials. These shall be grouped on article number for each material type and dimension. Thereby components can be traced from document (drawing) to relevant group of certificates.

NOTE: Traceability for welding and NDE to be maintained in accordance with the contractors/suppliers own internal system, and is not required as part of DFO.

LIST OF CERTIFICATES

List of certificates shall be submitted with reference to model/type/manufacturer and the name of the test institution. Following type of certificate shall be listed:

- Calibration certificates.
- PSV certificates.
- Ex-certificates.
- Type approval certificates.
- Pressure test certificates.

Certificates shall be available upon user request during the warranty period.

THIRD PARTY VERIFICATION AND CERTIFICATES

Third party verifications and certification shall be included when required by authority regulations.

PHOTOS OF SUBMERGED STRUCTURES / EQUIPMENT

For risers/J-tubes, subsea structures, submarine pipelines and cables, photos including identification of main components, distances etc. shall be provided. Any video recordings (visual inspection) shall also be provided.

A7 DFI RESUMÉ

The design fabrication and installation resumé as required by NPD shall provide a brief description of the installation, based on documentation from the design fabrication and installation phase.

All information required for inspection and maintenance planning throughout the lifetime of the installation shall be included in the DFI resumé.

The document shall give an account of the preassumptions on which the acceptance criteria have been based, and a description of the installation when it is put into operation.

It is emphasised that the requirements to documentation and description in the F and I sections of the resumé is only applicable to deviations from design criteria, standards, specifications etc.

DFI resumés shall be produced in accordance with the requirements of the NPD regulations and guidelines for the petroleum activity.

A8 TAG INDEX

A tag index shall be provided, containing information of all tagged bulk components/components installed, irrespective of type. The following information shall be included:

- Tag code.
- Tag description, function related.
- Area location code.
- Discipline ('owner' of the tag).
- Reference to:
 - Manufacturer.
 - Model/type.
 - Serial number for components.
 - Part list with parts identification codes.
 - Registration of spare terminals and wires.
 - Fire area clarifications.

To facilitate efficient traceability and updating of related information, documents describing the design shall be cross-referenced against all relevant tagged functional locations. The following information shall be included:

- Document, tag cross reference.
- Document number.
- Tag code.

A9 HEALTH, SAFETY AND ENVIRONMENT

Health, safety and environment data shall be delivered according to statutory regulations. A safety data sheet index for the complete installation shall be provided.

A10 WEIGHT DATA

Weight information shall be supplied according to NS 2130 and NS 2131.

A11 FIRE AREA LOCATION INDEX

The index shall include:

- Area identification code.
- Area description.
- Area classification (zone 1, 2 or non-hazardious).
- Ventilation condition for the 'fire area' (mechanical or natural ventilation, overpressure, underpressure).
- Personnel occupancy (continuously manned, no occupancy, etc.).
- Area enclosure (open, cladding, etc.).
- Combustible hazard (Hydrocarbon, GAS-H₂, etc.).
- Fire/Gas detection (GAS-Hydrocarbon in area, GAS-Hydrocarbon vent intake, etc.).
- Protection (deluge, water spray, etc.)

A12 SINGLE LINE INDEX

(For equipment Ref. NS 5820, Single Line Diagram)

A single line index, shall be provided for power distribution of 230V and below, instrument and telecommunication included. The following information shall be included:

- Distribution board tag code (*).
- Circuit number / incomer number (*).

- Circuit type (ref example).
- Wiring details for all inline units.
- Inline component identification.
- Consumer tag code (*).
- Type of consumer (if not identified through tag syntax) (*).
- Spare circuits to be registered as such (type: Spare) (*).
- Description of non-tagged consumers (control circuits etc.) (*).
- Location/address of non-tagged consumers (*).
- Consumer cable number (*).
- Termination details - consumer cable number (*).
- Termination details - tripping relays/contactors (inline component).
- Type of external signal (fire & gas trip signal etc.).

The following related information shall be available in its respective indexes:

- Tag codes in tag register.
- Power and current rating (datasheets) (*).
- Inline components (datasheets for components).
- Cable sizes (from cable list registration) (*).
- Reference drawings, including ref. to circuit diagram for circuit when applicable (crossreferencing requirement) (*).

For deviations from the typical solutions (circuit type's), drawings including all of above information as a minimum, shall be provided. Additionally, all above information marked with (*), shall be registered.

A13 CABLE INDEX

(For equipment ref. NS 5820 - Cable List)

A common cable index for electrical, telecommunication and instrument shall contain:

- Cable number.
- Cable length.
- Type of cable.
- Tag code both ends.
- Gland sizes.
- Routing of cables (data input from node diagrams).

Cable ladders and transits shall be given their identifying references on a nodal diagram, which is an isometric representation of a ladder layout. Identifying references shall be marked on the cable ladders and penetration transits. Each end of a cable ladder segment shall be bounded by a node point number to indicate that this is the start or finish of any particular segment.

For the purpose of cable routing and administration, a computerised program shall be used.

A14 RELAY SETTING INDEX

A Relay setting index is required for all high and low voltage protection relays. This index shall include the following information:

- Switchgear tag code.
- Cubicle no.
- Phase for relay connection.
 - Relay.
 - Manufacturer.
 - Model/type.
 - Relay range boundaries.
 - Relay settings.
- Current/voltage ratio.
- Relay selectivity reference (as defined in Selectivity analyses/relay coordinations study).

A15 LOOP INFORMATION

(For equipment ref. NS 5820 - Loop diagram)

Loop information:

- Shall be provided in electronic format sufficient to enable generation of loop diagrams, either as graphical reports or as alphanumeric reports.
- Shall be provided for instrumentation and telecommunication installations as well as for the control cabling for the electrical power installations.
- Shall include the following information:
 - Tag code for all equipment in loop.
 - Termination details for all cables between tags in the loop (field equipment, junction boxes, Main Distribution Frame's, main equipment terminal boards - external cables).
 - Crosswiring details (junction boxes and Main Distribution Frame's).
 - Cable details like cable number, pair numbers, core colours, cable type.
 - System programming information as switch number, port number, channel number, signal tag code. etc.
 - Amplifier number and zone number (Public Address systems).
 - Signal type (control signals).
 - Process hook-up.

A16 ANODE INDEX

An index shall be provided containing the following information:

- Identification and location of all sacrificial anodes.
- Identification and location of all electrodes and monitored anodes.

A17 LINE INDEX

The line index shall contain the following information:

- Line number (Tag code).
- P&ID document number.
- Service from' tag code.
- Service to' tag code.
- Test class.
- Test medium.
- Test pressure (barg).
- Chemically clean.
- Wall thickness.
- Schedule.
- Heat tracing degree C.
- Insulation class.
- Corrosion allowance.
- Critical line.
- NDT-class.
- Calculation number.
- Stress calculation number.
- Stress iso number.
- Nominal size.
- Density vapour/liquid.
- Viscosity vapour/liquid.
- Liquid fraction.
- Calculation method.
- Fluid.
- Mass flow.
- Compressibility.
- Velocity.
- Pressure drop calculated and allowed.
- Operating pressure.
- Design pressure.
- Operating temperature.
- Min/max temperatures.
- Design temperature.

A18 SYSTEM CONFIGURATION INDEX

This index shall hold information related to the control systems such as primary signals, I/O cards, functions and group alarms in the control systems.

A19 LUBRICATION INDEX

The lubrication index shall contain the following information:

- Model/type of component.
- Lubrication point sequence number.
- Lubrication points.
- Supplier lubricant (product type).
- Quantity first.
- Quantity normal.
- Intervall.

A20 CONSUMPTION DATA

Consumption data inclusive electrical load list shall be given for all utility, drilling and process consumers.

A21 FLOW DIAGRAMS

Process and safety flow diagrams for main "process" and auxiliary systems. Process parameters shall be shown on corresponding indexes such as line index and tag index.

HVAC flow diagrams (Air distribution diagrams) shall be provided per system and include Tag codes for supply and extract fans (air-handling units) and Area codes and description for all serviced areas.

Information such as:

- Flowrates for supply and extract fans (air-handling units).
- Flowrates for all serviced areas and air flows necessary for system balancing.
- Temperature requirements for all serviced areas.
- Notes regarding main design parameters, such as fan stand-by philosophy, emergency operation shall be given under A4.

Typical flow diagram process is shown in Annex B.

A22 PIPE & INSTRUMENT DIAGRAMS (P&ID)

(For equipment ref. NS 5820)

Fully completed P&ID's shall contain the following details:

- All process and utility equipment shall be shown and tagged.
- Equipment data summary with tag number and system.
- Elevation of main equipment.

- Drip trays.
- All instrumentation reflecting the control functions such as control loops, logic functions, pre-alarms, trips, signal types, tag numbers, local instruments, connections to local control, central control room, emergency shutdown system, process shutdown system, pressure safety valve and blowdown valve systems and the system control and data acquisition system when provided.
- All instrument locations shall be indicated and completed with tag numbers.
- All valves such as isolation valves, control valves, check valves, relief valves, shut-down valves, blow-down valves, block valves, bleed valves size and type shall be indicated and completed with tag numbers.
- Mechanical lock and interlocks.
- All functional control instruments inside packages with tag numbers.
- All process and utility lines including equipment connections, and interconnecting pipework.
- Inline equipment and piping items such as straightening vanes, spool pieces expanders, maintenance spools, reducers and temporary strainers.
- Clean-out and sample connections.
- Piping class breaks.
- Labels on entering and leaving lines giving medium and source/destination.
- All lines shall be sized and numbered. Material and insulation specification shall be included.
- All line number and/or specification changes shall be identified.
- All manual valves and specification added, correctly shown as normally open/closed.
- Fail/open/fail closed position of actuated valves.
- Information on lines such as line slope requirements, symmetrical piping requirements etc.
- Packages shall be identified with limit of responsibility between contractor and others.
- Connections to other systems.
- Connections to other equipment and packages eg. steam out, vent, manholes, drains etc.
- Isolation and spading of equipment.
- All flanges and drains in lines.
- Winterisation.
- Area changes shall be shown on lines.
- Utility stations.
- Piping special items.

Typical P&ID is shown in Annex B.

A23 DUCT & INSTRUMENT DIAGRAM (D&ID)

Air distribution diagrams shall be provided pr system and include the following information:

- All HVAC equipment shall be shown and tagged.
- Equipment data summary with tag number for all main equipment such as filters, fans, coils.
- All ductwork identified with system no., sizes, duct classes, insulation classes.
- Air flow to all serviced areas.
- Area breaks and duct class breaks.
- All areas served to be identified.
- All instrumentation reflecting the control functions.

- All instrument locations shall be indicated and completed with tag numbers.
- Connections to other systems e.g. sea water, heating medium, drain etc.

A24 ISOMETRIC DRAWINGS

FABRICATION ISO's

Piping shall be documented on fabrication ISO's including the following information:

- North arrow.
- Line number(s).
- Reference to adjacent ISO-drawings.
- All inline equipment with tag code.
- Piping-class.
- Special items with coding.
- Penetrations.
- Dimensional details (spool and equipment lengths).
- Platform coordinates (elevations and xy).
- Reference to piping general arrangement & P&ID's.
- Weld location and number.
- Material type.
- Material takeoffs including stock number.
- Weight and centre of gravity.
- Pipe supports with identification.

HEAT TRACING ISO's

Heat tracing installation shall be documented on fabrication ISO's including the following information:

- Graphical presentation of heat tracing cable (where installed).
- Heat tracing cable numbers.
- Power supply cable numbers.
- Junction boxes with tag code.
- End seal of heat tracing cable.
- Splice of heat tracing.

STRESS ISO's

- Line number.
- Stress summary, reports and calculation.
- Restraint/anchor loading and displacement.
- Spring summary.

PRESSURE TESTING ISO's

An isometric drawing shall be provided for each system that shall be hydro-tested, including information as:

- Connection point for pressure test equipment.
- Pipe blindings.
- HVAC ISO's
- All duct and equipment including flanges, maintenance area and measuring points.
- Grid with main coordinates.
- Deck elevations/major elevations.
- Tag codes.
- Material type.

A25 DATA SHEETS

Datasheets shall be provided for systems, components and bulk components. Norsok standard data sheets shall be used.

A26 GENERAL ARRANGEMENT

General arrangement drawings shall be prepared for packaged units in accordance with NS 5820.

A27 LAYOUT DRAWINGS

To the extent CAD modelling has been applied in the design phase, layout drawings shall preferably be replaced by isometric views, plan views and related cross-sectional drawings from the model.

Layout drawings shall be supplied for:

- All main equipment.
- HVAC ducts 300mm.
- Cable ladders/cable trays 300mm.
- Lighting and small power.
- Telecom.
- Architectural (LQ).

Layout drawings shall include:

- Tag code.
- Location.
- Dimension and geometrical form of main equipment.
- Main dimensions for the area and the equipment as such.
- Main and escape routes.
- Lay down areas.

For areas heavily equipped, such as control rooms, equipment rooms, telecom centre, individual layout drawings shall be provided per discipline. Cross-sectional views shall be provided when required for accurate identification of location.

A28 LOCATION DRAWINGS (PLOT PLANS)

All main and field equipment shall be included, one per area and discipline, identified by:

- Tag code.
- Type of equipment (relevant symbol).

Normally, location drawings are based on layout drawings without dimensional details.

All lifting lugs shall be shown on separate location drawings coordinated by area. Supplier provided lifting lugs are shown on supplier general arrangement drawings and identified in the part list.

A29 STRUCTURAL INFORMATION

MAIN STRUCTURAL STEEL DRAWINGS SHALL INCLUDE

- Arrangement.
- Main dimensions.
- Main/critical welds with reference to weld summary index.
- Reinforcement.
- Embedded items.

SECONDARY AND OUTFITTING STEEL

- Arrangements.
- Main dimension.

STRUCTURAL FIRE PROTECTION DRAWINGS

Drawings showing the extent and thickness of fireproofing.

ACOUSTIC/THERMAL INSULATION AND FIRE PROTECTION

Acoustic insulation, thermal insulation and fire protection details as follows shall be included:

- All doors and windows.
- All insulation in ceiling, floors and walls.
- Blast/fire walls.

A30 FREE SPAN CALCULATION

Free span calculations shall be provided where there is no contact between seabed and the pipeline (free spans). The following design criteria shall be investigated:

- Excessive yielding.
- Fatigue.
- Interference with human activities (trawling).

Maximum allowable free span lengths shall be established for both the installation and operational cases. Potential areas where free spans can develop shall be identified and procedures with recommended method(s) for free span rectification shall be included.

A31 SYSTEM TOPOLOGY AND BLOCK DIAGRAM

- System topology (Overall system block diagram) shall show configuration of systems and subsystems to give a functional understanding. Typical contents shall be:
 - All related systems and subsystems represented by blocks.
 - Location.
 - Interface and wiring between blocks shall be indicated.
 - Subsystem block diagram showing relation between functional units within a subsystem. Typical information shall be:
 - The function of each unit (block):

Short description, supplied with function identification code if applicable.

- Interface between blocks and interface to other equipment:

Signal type and function (typ. RS232, control signal) if applicable.

- Location of the equipment, either by text labelling of each block or by blocks located in dotted area boxes.
- Heat tracing block diagram.

Typical system topology and block diagram is shown in Annex B.

A32 SINGLE LINE DIAGRAM

(For equipment ref. NS 5820)

Overall single line diagrams for all voltage levels shall be provided, including all power distribution units (generators, switchgears, transformers, distribution boards, rectifiers, batteries etc.) throughout the distribution system.

Power distribution throughout both the electrical, automation and telecommunication installations shall be included. End consumers shall be included for high-voltage switchgears only.

Separate earthing single line diagrams, including all main equipment, shall be provided for the electrical, instrument and telecommunication installations. The general earthing principles shall be included to ensure correct earthing of systems, equipment and cables.

Typical single line diagram is shown in Annex B.

A33 CIRCUIT DIAGRAM

(For equipment ref. NS 5820)

Diagrams (switchgears/-boards) for all feeders and control circuits shall include:

- All internal connections for control, alarms, protection, interlocks, trip functions, monitoring etc.
- Range of timers, thermal overload and protection relays.
- Internal wire numbers.
- Terminal numbers.
- External wire and cable numbers.
- Component list for inline, control and protection components.
- Switchgear/-board tag code.
- Cubicle number.
- Consumer tag code.
- Type of consumer (if not identified through tag syntax) spare cubicles or part of cubicles to be registered as such (type: Spare).
- Consumer cable number.
- Termination details - consumer cable number.
- Type of external signals (fire & gas trip signal etc.).
- Power and current rating.
- Reference drawings.

Typical circuit diagram is shown in Annex B.

A34 LOGIC DIAGRAM

(For equipment ref. NS 5820)

The Logic diagrams shall be available as graphical reports, or program listings documenting the function of the program. Modes of operation like starting, shut down, alarm and trip functions shall be indicated in the diagram.

To clarify the overall system logic a System control diagram may be used.

Typical logic diagram is shown in Annex B.

A35 LEVEL DIAGRAM

Level diagrams shall be made for:

- The feeder arrangement of all radio systems including transceiver ports and antennas.
- Interconnection signal lines between subsystems and to other systems.
- External lines where signal level is not set by standard.

Levels shall be given in dBm in conjunction with standardised impedances. If impedance is non standard or undefined, voltage levels shall be given. Where applicable, impedances and wire configuration should be indicated (2W, 4W, coax, E&M, etc.).

A36 CAUSE & EFFECT

(For equipment ref. NS 5820, Logic diagram)

Cause and effect diagrams shall be available as graphical reports generated from the control system configuration indexes. If this cannot be achieved, Cause & effect diagrams shall be produced in accordance with Annex B dwg. no A36 and in raster format.

A37 WIRING DIAGRAMS

The termination diagram for external connections shall include:

- Terminal block/socket number.
- Terminal/pin number (including spares).
- External cable numbers with pair and core colour details.
- Destination for external cables.
- Earthing details.
- Equipment and equipment connections.

Typical wiring diagram is shown in Annex B.

A38 PNEUMATIC/HYDRAULIC CONNECTION DRAWING

The hook-up drawing shall indicate all details of the actual installation for the relevant instrument tag number, such as:

- All instrument/bulk material installed.
- Connections and dimensions of signal lines/tubing.
- Indicate split of responsibility instrument/piping.

A39 TELECOMMUNICATION NETWORK SCHEDULE

- Transmission budgets for radio links, satellite hops and fibre optical cables.
- Commissioning test results for:
 - Radio systems.
 - Public address (PA) central systems.
 - Audio and video distribution network.

A40 PIPING SUPPORTS

- Detail drawing/support standard.
- Location.
- Identification.
- Pipe support index.

ANNEX B TYPICAL DOCUMENT EXAMPLES (INFORMATIVE)

FLOW DIAGRAM PROCESS (Dwg no. A21)



[GIF-image](#) (14 Kb)



[AutoCAD-drawing](#) (85 Kb)

P&ID (Dwg no. A22)



[GIF-image](#) (10 Kb)



[AutoCAD-drawing](#) (69 Kb)

SYSTEM TOPOLOGY AND BLOCK DIAGRAM (Dwg no. A31)



[GIF-image](#) (12 Kb)



[AutoCAD-drawing](#) (58 Kb)

SINGLE LINE DIAGRAM (Dwg no. A32)



[GIF-image](#) (12 Kb)



[AutoCAD-drawing](#) (41 Kb)

CIRCUIT DIAGRAM (Dwg no. A33)



[GIF-image](#) (9 Kb)



[AutoCAD-drawing](#) (74 Kb)

LOGIC DIAGRAM (Dwg no. A34)



[GIF-image](#) (8 Kb)



[AutoCAD-drawing](#) (55 Kb)

CAUSE & EFFECT DIAGRAM (Dwg no. A36)



[GIF-image](#) (19 Kb)



[AutoCAD-drawing](#) (85 Kb)

WIRING DIAGRAM (Dwg no. A37)



[GIF-image](#) (10 Kb)



[AutoCAD-drawing](#) (52 Kb)