

DEP SPECIFICATION

HYDRAULIC SYSTEMS FOR THE OPERATION OF ON/OFF VALVES IN PROTECTIVE FUNCTIONS

DEP 31.36.10.30-Gen.

February 2011
(DEP Circular 65/11 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for hydraulic systems for the operation of non-spring loaded on/off valves in (instrumented) protective functions.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated January 2010; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

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

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
DCS	distributed control system
DE	de-energised
ESD	emergency shut down
IPF	instrumented protective function
IPS	instrumented protective system
MCC	motor control centre
PLC	programmable logic controller
PFD	Probability of Failure on Demand
SCU	self-contained hydraulic unit – A compact power pack, integrally built with actuator on top of or next to an on/off valve.
SIL	safety integrity level

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (8).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2010. The following are the main, non-editorial changes.

Old section	New section	Change
2.3	2.3	Optional content of the hydraulic system added..
2.8	2.8	Reworded to better cover fire safety requirements.
4.1	4.1	Sections 4.1.1 and 4.1.2 combined in 4.1.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://swwww.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.7 DUAL UNITS

**Amended per
Circular 65/11**

Dual units have been incorporated throughout this DEP.

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. HYDRAULIC SYSTEMS – GENERAL REQUIREMENTS

2.1 GENERAL

It may be desirable to create an independent power source and instrumented protective function (IPF) to meet the PFD requirements during emergency conditions (e.g. fire). Hydraulic systems can meet these requirements relatively simply.

The hydraulic system shall be designed so that troubleshooting and maintenance can be carried out with minimum disruption to the operability of the system.

Minor equipment faults (e.g. a small leakage of hydraulic fluid, nitrogen, or instrument air supply) should not disturb normal plant operations. Furthermore, unintentional opening or closing of the on/off valves shall not be possible (e.g. due to a supply pipe burst or for any other reason).

The layout of a hydraulic system is shown schematically in (Figure 1).

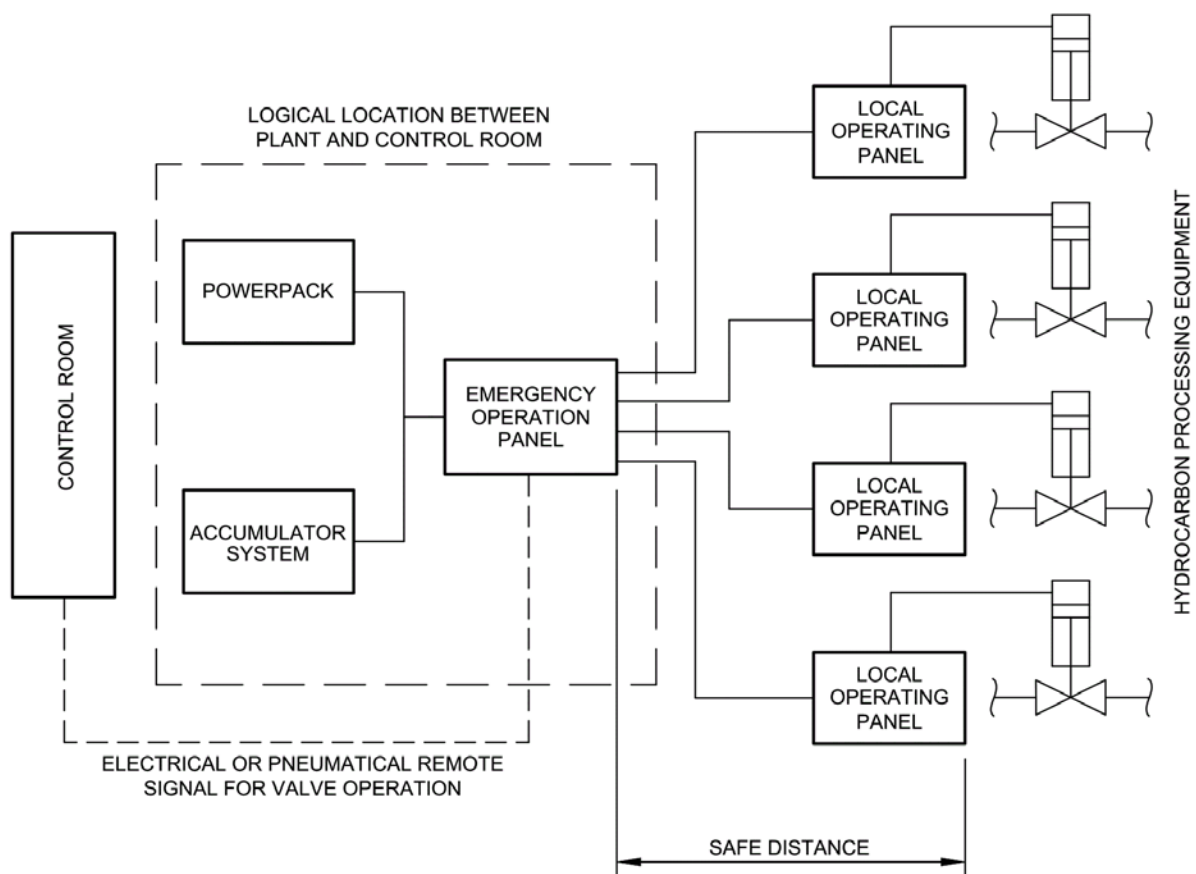


Figure 1 Layout of a hydraulic system for the operation of on/off valves with a protective function

2.2 ORDERING

2.2.1 Requisitioning

The Principal SHALL [PS] specify in the requisition the functions, requirements, and types of on/off valves to be installed, as well as the basic requirements for the actuator and hydraulic system packages.

The hydraulic system Supplier shall be responsible for the engineering, delivery, and functioning of the entire system, including assembling of on/off valves.

The **valve** Manufacturer shall be responsible for the performance of the **valve** and assembly, and SHALL [PS] provide data to the hydraulic system Manufacturer to sufficiently size the actuator; see (2.7).

The Principal shall specify in the requisition whether or not installation supervision by the hydraulic system Supplier is required at site.

The hydraulic system SHALL [PS] be suitable for outdoor operation in the prevailing local environmental and weather conditions, as indicated in the requisition. Painting shall be in accordance with DEP 30.48.00.31-Gen.

This DEP shall be used in conjunction with Requisition sheet DEP 31.36.10.93-Gen. and Requisition for Engineering Documents (RED) sheet DEP 40.10.01.93-Gen.

2.2.2 Information to be submitted with the Tender

A hydraulic flow scheme ("Process Engineering Flow Scheme - PEFS") shall be provided showing all equipment, lines, valves, and instrumentation and indicating limits of supply. The following information shall be included as a minimum:

- specification of the pump capacity, accumulator capacity, reservoir capacity, heating and/or cooling requirements;
- minimum system pressure to close and open all on/off valves;
- minimum required hydraulic fluid/nitrogen volume;
- maximum system pressure;
- normal operating pressure;
- return line pressure (not applicable to an SCU);
- weights and outline dimensions of the modules;
- main dimensions of the power pack with oil reservoir and of the mobile unit;
- completed noise limitation sheet, DEP 31.10.00.94-Gen.;
- names of all proposed sub-suppliers with a full description of the equipment being supplied by them;
- required spare parts for commissioning;
- spare parts required for day-to-day maintenance for a period of three years after commissioning;
- special tools required;
- list of deviations, if any, from the requirements of this DEP.

2.3 CONTENT

Each hydraulic system SHALL [PS] consist of the following main components:

a power pack for the supply of the hydraulic pressure and flow rate;

- an accumulator back-up system to ensure full hydraulic pressure in case of pump failure;
- emergency operating panel(s);
- hydraulic actuator(s) to operate the on/off valves;
- interconnecting piping;
- electric cables/wiring;
- instrumentation;
- tubing;

- hydraulic fluid filter unit;
- skids/racks;

Optional the hydraulic system can be provided with the following components:

- local operating panel(s)
- a mobile hydraulic pump unit
- heating
- weather/fire shielding

2.4 LAYOUT

The layout of the hydraulic system SHALL [PS] meet the following requirements:

- The power pack, the accumulator system, and the emergency operating panel be located well away from the related on/off valves.
- The location be freely accessible and unlikely to be affected by a fire, and allow a reasonable view of the related equipment area.

The local operating panel, if applied, shall be located adjacent to, or near, the related on/off valves.

The hydraulic system shall be split into multiple systems as shown in (Figure 2) if any of the following are applicable:

- more than 25 on/off valves have to be operated (depending on size this figure may vary);
- the distance between groups of on/off valves is greater than 50 m (150 ft) (on average, figure may vary);
- On/off valves are installed far apart, to achieve a safe location for the emergency operating panel.

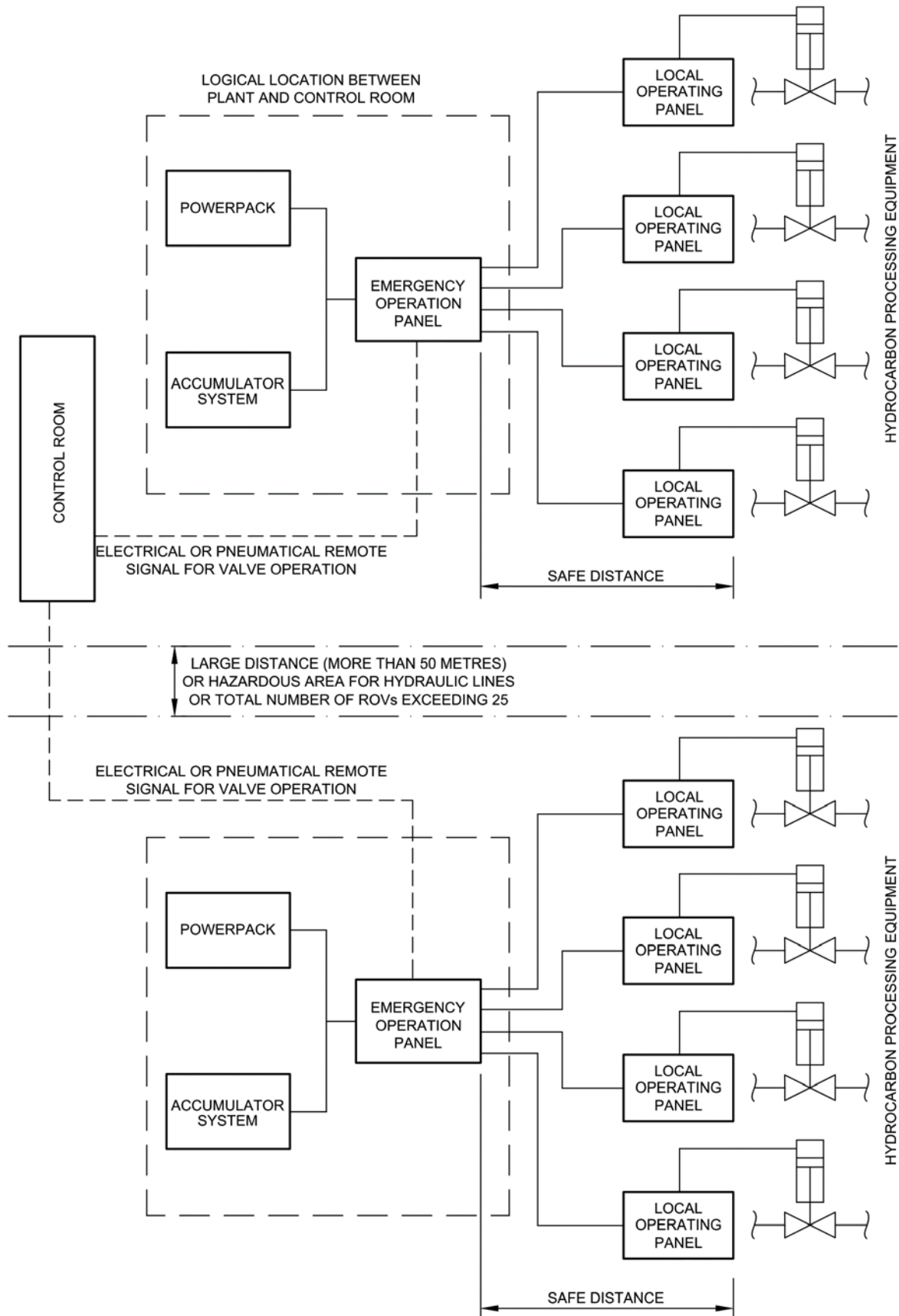


Figure 2 Layout of multi-hydraulic systems for the operation of on/off valves with a protective function

The installation of one SCU per on/off valve should be considered if:

- The on/off valve is located a long distance away from the rest of the group or;
- The number of on/off valves does not justify a central hydraulic system (see Figure 3).

For specific requirements for SCUs, see (2.6) and (4.2.2).

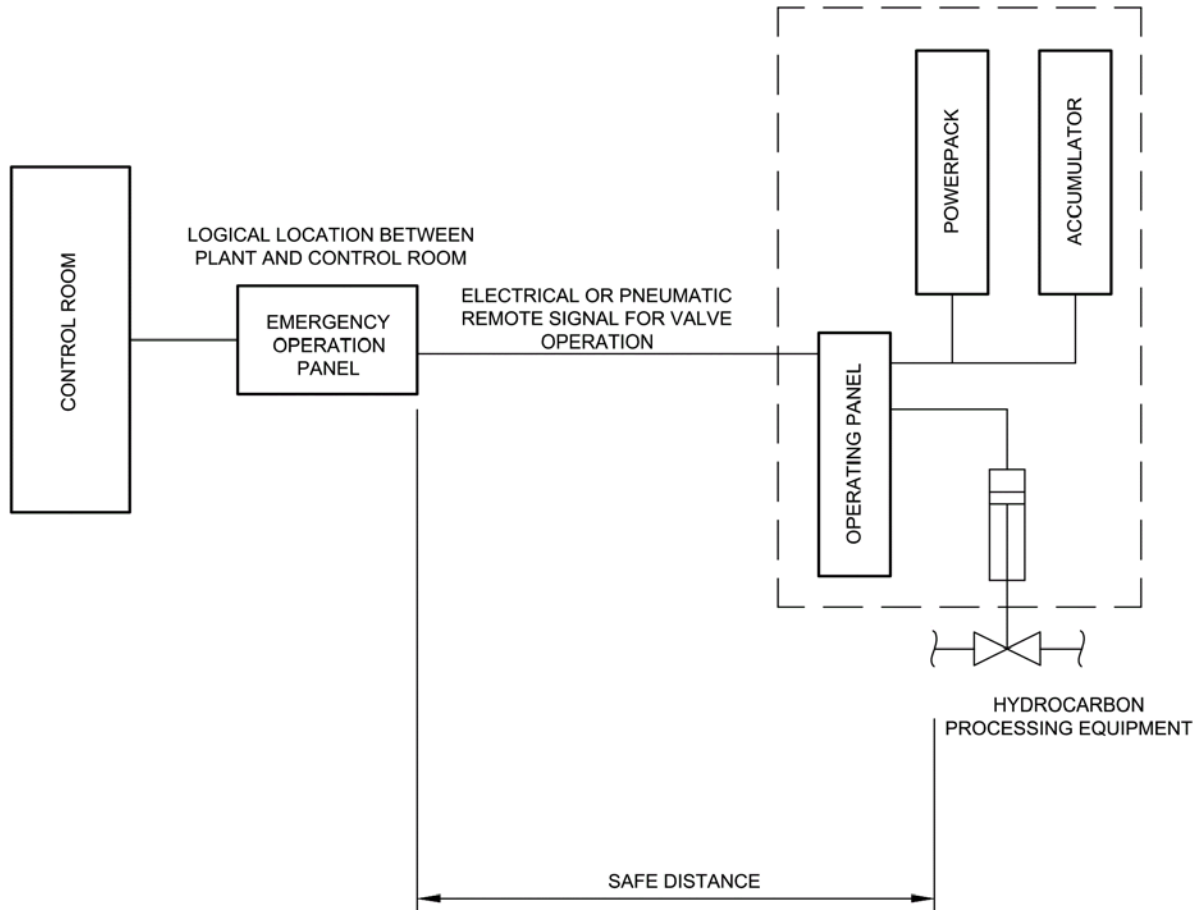


Figure 3 Layout of self contained hydraulic unit for the operation of on/off valve with a protective function

For particular applications (e.g. loading arms), the Principal may decide that the on/off valves will be controlled remotely only. A configuration as shown on Figure 4 can then be used. No emergency operating panel is required.

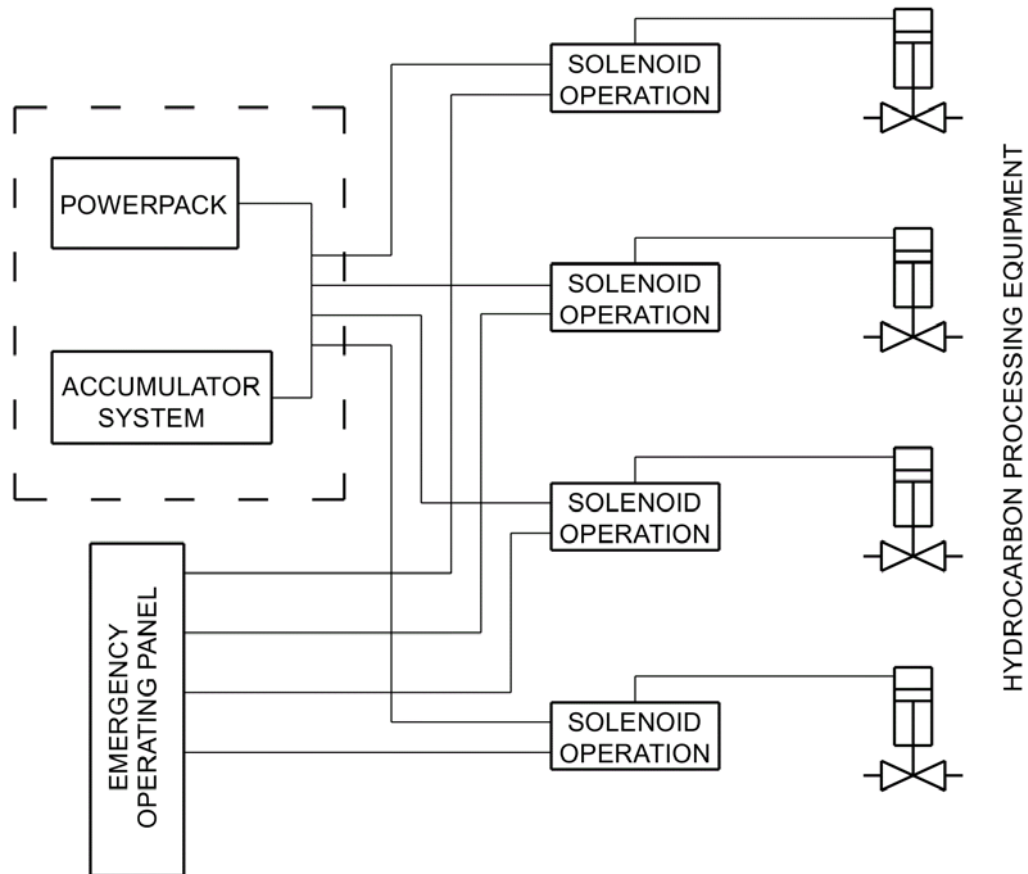


Figure 4 Layout of a hydraulic system for actuated on/off valves with operation only from control room

2.5 CONFIGURATION

The power pack, accumulator rack (including nitrogen bottles) and emergency panel shall be built on a common skid as far as is practically feasible.

The actuator and on/off valve SHALL [PS] be built as a common unit. Integration of the local operating panel is acceptable if the requirements of (3.7) are met.

The Principal SHALL [PS] indicate if the modules have to be fire-resistant, when necessary a fire-resistant box or enclosure SHALL [PS] form an integrated part of the module. The enclosure may cause it to be classified as a hazardous area and the hydraulic system SHALL [PS] then be designed accordingly.

2.6 SELF-CONTAINED HYDRAULIC UNITS

Self-contained hydraulic units (SCUs) shall be designed and built so that the on/off valve actuator, power pack, accumulator, nitrogen bottle, instrumentation, and local operation panel are integrated into one unit of modular construction.

This DEP SHALL [PS] likewise apply for SCUs, except that:

- A spare pump is not required.
- The pumps SHALL [PS] have sufficient capacity to charge the accumulator from the empty condition to the full condition within 15 minutes unless flow is required to allow