TECHNICAL SPECIFICATION

DEFINITION AND DETERMINATION OF TEMPERATURE AND PRESSURE LEVELS

DEP 01.00.01.30-Gen.

October 1995
(DEP Circular 06/97 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

PREFACE

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

Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

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.

The right to use DEPs is granted by SIOP, SIEP or SIC, in most cases under Service Agreements primarily with companies of the Royal Dutch/Shell Group and other companies receiving technical advice and services from SIOP, SIEP or SIC. Consequently, three categories of users of DEPs can be distinguished:

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.

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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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1. INTRODUCTION

1.1 SCOPE

This DEP, which is a revision of an earlier DEP with the same title and number dated October 1985, defines a consistent terminology for the various temperature and pressure terms used in design and operation.

Use of this terminology will facilitate communication between process designers and mechanical designers.

This DEP also gives guidelines to determine temperature and pressure levels essential for safe and efficient design and operation.

The rules given in this specification do not relate to atmospheric storage tanks.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of the Royal Dutch/Shell Group or managed by a Group company, and to Contractors nominated by them (i.e. the distribution code is "C" as defined in DEP 00.00.05.05-Gen.).

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

If national and/or local regulations exist in which some of the requirements may 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 as regards 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 with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

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

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 authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions and abbreviations

Other specific definitions for pressures and temperatures are detailed in (3) and (4).

1. The term **intended operation** used in this DEP means that the process conditions, i.e. temperature, pressure, flow, fluid compositions, etc., are stable and in accordance with the process design.
2. **Pressure relief valve** used in this DEP is a generic term for relief valves, safety valves or safety/relief valves.

3. **Pressure relief device** used in this DEP is a generic term for pressure relief valves, bursting disks, or other mechanical emergency relief appliances.

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 (5.).

2. GENERAL INFORMATION

Equipment and piping systems shall be designed such that mechanical integrity is maintained under all coincident process temperature and pressure conditions to which these systems can be exposed.

The installation shall be able to withstand the most unfavourable expected temperature and pressure combinations during starting-up, normal operation and shutting-down. If an installation or part thereof is designed for different feedstocks, or if periodic regeneration processes have to be carried out, the associated maximum and minimum operating temperatures with the coincident pressures shall be determined for each process condition.

NOTE: The coinciding pressure and temperature combination for the determination of wall thickness can be different from the temperature to be used for material selection.

To accommodate these requirements, adequate pressure and temperature margins are specified between the most stringent coincident operating conditions and the mechanical design levels.

In addition, the installation shall remain safe under abnormal operating conditions caused by, for example, malfunctioning of instrumentation, incorrect operation, utility failure, external fire, liquid heated by solar radiation, emergency conditions, etc.

If the mechanical design levels can be exceeded under such abnormal conditions the equipment shall be protected by pressure relief devices. Only in cases where the application of pressure relief devices is either impossible or impractical may instrumented protective functions be considered, subject to the approval of the Principal.

3. PRESSURE SYSTEM

A **pressure system** is a system which, within its boundaries, is open. A pressure system consists of process equipment, such as columns, heat exchangers, vessels, etc., interconnected by piping with no valves (except non-return valves in certain situations, see 4.2.1.3.1).

A pressure system may be protected by only one (set of) relief valve(s), provided it is ensured that the system, within its boundaries, remains open under all conditions.

However, a pressure system is considered not to be open within its boundaries if the flow under maximum relief conditions exceeds three times the normal operating mass flow unless it can be demonstrated that blockage due to freezing, solidification, fouling, sublimation, damage of internals, scale, debris, illicit objects, etc. cannot occur.

From a protection standpoint, the pressure relief device assembly should be located in the part that is nearest to the source of overpressure, usually the upstream section.

NOTE: In case a pressure system has been defined along the above requirements, it does not automatically result in identical design pressures for all parts of equipment. After assessing the most unfavourable pressure profile over the open connections between equipment whilst the system is under maximum relief conditions, the design pressure for each piece of equipment in the pressure system shall be established. In this case the pressure in any part of the pressure system shall never exceed the equipment design pressure.

4. TEMPERATURE AND PRESSURE LEVELS

4.1 TEMPERATURE

4.1.1 Operating temperature (OT)

The OT is the temperature which exists inside equipment and piping during any intended operation.

The OT is determined by the process engineer.

In many cases temperatures different from those required for the intended operation can occur, e.g. during starting-up, shutting-down, drying, regeneration, steam-air decoking, heating-up to maximum ambient temperature, including solar radiation, fouling of heat exchangers, failure of cooling medium and heat exchanger by-passing, etc.

The question whether such a temperature should be specified and taken as the operating temperature, the maximum operating temperature (see 4.1.2), or the emergency design temperature (see 4.1.4) shall be considered individually and the reason for the specification shall be stated in the pertaining documents.

4.1.2 Maximum operating temperature (MOT)

Amended per Circular 06/97

The MOT is the highest temperature which provides sufficient flexibility for the control of the intended operation.

In many cases this flexibility is not required and in those cases the MOT is equal to the OT.
For pressurised LPG storage facilities the MOT is either the maximum temperature on product receipt into storage or the assessed temperature for the relevant climate (refer to DEP 30.06.10.12-Gen.), whichever is higher.

The MOT is determined by the process engineer in consultation with the process control engineer.

NOTE: The MOT is normally used as the basis for materials selection with respect to long term corrosion and/or material degradation. Therefore, any subsequent proposed change in MOT shall be scrutinised to confirm the continued suitability of the material.

4.1.3 Design temperature (DT)

Amended per Circular 06/97

The DT (often referred to as the upper design temperature, UDT) is the highest temperature at which equipment may be subjected to the upper and/or lower design pressure.

The DT (UDT) is initially selected by the process engineer and finally determined in close consultation with the mechanical design engineer.

The DT is typically 10 °C above the OT and shall not be lower than the MOT.
For pressurised LPG storage facilities the DT is equal to the corresponding boiling temperature at derived design pressure (see 4.2.1.3) and assessed LPG composition.

The DT is used for mechanical design (e.g., determination of minimum wall thicknesses and other physical characteristics) of equipment and piping. In exceptional cases (e.g. where a higher alloy material would otherwise be required because of oxidation or creep) a DT of 5 °C above the OT may be selected.

NOTE: The mechanical design is normally based only on short term corrosion and/or material degradation effects. In such cases, although the material strength is sufficient at the DT, the material may not be suitable for extended operation at the DT. Therefore, any subsequent proposed change in MOT shall be scrutinised to confirm the continued suitability of the material.

A separate set of design pressure and temperature conditions shall be specified to cater for steaming-out operations, with the DT at least 150 °C (which is the condensing temperature of the steaming-out medium).

For tubes in fired equipment the DT is the temperature determined by the rules specified above or the calculated maximum tube skin temperature, whichever is higher.

4.1.4 Emergency design temperature (EDT)

The EDT is the maximum temperature that can be reached under unintended, but possible, emergency conditions other than external fires (see DEP 80.47.10.30-Gen. for specific fire protection measures). Temperatures resulting from runaway reactions or from decomposition of thermally unstable materials shall be addressed separately in consultation with the Principal.

Emergency conditions should be assumed to exist only for the time required to correct the situation. These conditions shall be taken into account both in materials selection (for corrosion and/or material degradation) and mechanical design, recognising that these conditions prevail for a limited period of time and not indefinitely.

The duration of the emergency and the materials selection limitations shall be agreed with the Principal.

4.1.5 Lower design temperature (LDT)

The lower design temperature is the lowest temperature at which equipment may be subjected to its design pressure (for material selection purposes the lower design temperature may be below this value; see DEP 30.10.02.31-Gen.).

The LDT is initially selected by the process engineer and finally determined in close consultation with the mechanical design engineer.

Construction materials shall be selected in accordance with DEP 30.10.02.31-Gen. to prevent brittle fracture under such circumstances as starting-up, shutting-down, depressurization or other operations.

4.2 PRESSURE

4.2.1 Pressures in process design and in mechanical pressure system design

4.2.1.1 Operating pressure (OP)

The OP is the gauge pressure which exists inside equipment and piping during any intended operation. The OP is determined by the process engineer.

4.2.1.2 Maximum operating pressure (MOP)

Amended per Circular 06/97

The MOP is the highest gauge pressure which provides sufficient flexibility for the control of the intended operation. The MOP is determined by the process engineer in consultation with the process control engineer.

The MOP is typically 105% of the OP. The MOP shall not be less than 1.0 bar above the OP, except for pressurised LPG storage facilities, where the MOP is equal to the vapour pressure at derived maximum operating temperature (see 4.1.2) and assessed LPG composition.

If this margin is not sufficient for control, starting-up, shutting-down or other specific operations, a higher MOP shall be specified. The reason for this increased MOP shall be stated in the pertaining documents.

4.2.1.3 Design pressure (DP)

The DP (sometimes referred to as the upper design pressure, UDP) is the gauge pressure at the top of the equipment in its operating position that is used as the basis to determine the minimum thickness of equipment parts at the DT.

The DP is initially selected by the process engineer and finally determined in close consultation with the mechanical design engineer.

Since the DP is related to the top of the equipment, for other parts or elements of the equipment the designer shall establish the associated design pressures taking into account the maximum pressure drop caused by flow through the equipment, plus the fluid static head.

4.2.1.3.1 Vapour and vapour-liquid systems protected by relief valves

Amended per Circular 06/97

For non-liquid full systems with a vapour relief to a common flare or vent system the DP is normally determined from the MOP by the following rules:

MOP bar (ga)	DP bar (ga)
> 0 ≤ 10.0	MOP + 1.0, but not less than 3.5
> 10.0	110% MOP

Equipment that are part of a pressure system protected by a relief valve discharging into a flare system or combined vent system shall have a design pressure of at least 3.5 bar (ga). Lower design pressures may be considered if the relief valve blows directly to atmosphere.

If a DP of 110% MOP would be substantially more costly than a DP of 105% MOP (e.g. because of a step up in flange rating), then 105% MOP may be acceptable provided suitable relief valves are used which can have their set pressure adjusted accurately. This shall be subject to the approval of the Principal.

In the determination of the margin between MOP and DP, account shall be taken of instrumented high pressure protective functions applied to prevent lifting of relief valves.

It shall be studied whether the application of design pressures which are appreciably higher than those that follow from the above rules, can result in an overall cost saving. This is likely if the equipment minimum wall thicknesses are not determined by internal pressure but by external pressure or external loads, e.g. wind load or the protection against deformation during transport and installation.

A higher DP permits higher set pressures, which will result in smaller pressure relief devices. Moreover, higher set pressures enable the accommodation of higher back-pressures resulting in smaller relief systems.

For reaction vessels or equipment in which an undesirable reaction can occur due to maloperation, it is noted that in general a higher setting of the pressure relief valve results in a higher relief rate in the case of a runaway. The rate of relief can be exponential, whereas the increase of the relief device capacity is only proportional to the pressure increase.

For batch reactions it could be possible at acceptable cost to select the design pressure such that in the case of runaway all reaction products are contained without exceeding the allowable pressure limits accepted by the Principal. In such a case the runaway relief condition can be ignored for the sizing of the relief system.

Equipment and piping at the discharge side of positive displacement compressors and pumps shall have sufficiently high design pressures to prevent the opening of pressure relief devices due to the pressure fluctuations.

For pumps and compressors the suction lines from and including the suction valve shall have the same design pressure as the discharge side except in cases where no suction valve is installed.

The DP of centrifugal compressor suction and intermediate stage systems, e.g. coolers, condensers, knock-out drums, etc., shall be sufficiently high to prevent the opening of pressure relief valves through pressure equalization after the compressor has tripped.

For detailed information on compressor design, reference is made to:

API Std 617, amended and supplemented by DEP 31.29.40.30-Gen.

API Std 618, amended and supplemented by DEP 31.29.40.31-Gen.

API Std 619, amended and supplemented by DEP 31.29.40.32-Gen.

API Std 672, amended and supplemented by DEP 31.29.40.33-Gen.

In case a pressure system contains one or more non-return valves, the protection of this pressure system against exceeding the DP shall take place downstream of these non-return valves. However, if a non-return valve is located in a fire area (see DEP 80.47.10.30-Gen.), the valve needs to be fire-resistant to guarantee an open path between the two sections during fire.

Only by applying this measure will the upstream part of the pressure system be protected by the relief device in the downstream part of the system. In other cases, the pressure system needs to be divided into at least two sub-systems, each with its own relief device.

In the assessment of design pressures for multi-compartment equipment, structural failure of separation walls shall not be considered except for tubes in heat exchangers (see 4.2.1.3.4).

To determine the design pressures of equipment handling explosive dusts, see memorandum CMFE 115/84.

For the acceptance of occasional variations of pressure and/or temperature above the design levels in piping systems, reference is made to the ANSI/ASME codes B31.1, B31.3, B31.4 and B31.8 as applicable to the system under consideration. However, piping systems shall at least have the design conditions of the connected equipment.

4.2.1.3.2 Vapour and vapour-liquid systems protected by bursting disks

For equipment protected by bursting disks an adequate margin is required between the maximum operating pressure and the specified minimum bursting pressure.

Rupture disks are highly stressed in service. In order to avoid premature failure due to the effects of corrosion, creep and fatigue, a substantial margin (at least 30% of the normal bursting pressure for tension-loaded disks, and at least 10% of the minimum bursting pressure for reverse-buckling disks) shall be allowed between the MOP and the design pressure of the vessel.

4.2.1.3.3 Liquid-full systems

Liquid-full systems shall be designed for pump shut-off pressure if these systems can be blocked in while pumps feeding these systems could continue to operate. The Principal shall be contacted if this would lead to excessive cost.

The shut-off pressure is the pressure at the discharge of a centrifugal pump with the suction pressure at the maximum possible value and the discharge system closed.

The shut-off pressure SOP is determined by the equation:

SOP = SP + HPS + HPO - HPD, in which

- SP = set pressure of the pressure relief device on the pump suction system (Notes 1 and 2)
- HPS = hydrostatic pressure of the liquid above the pump suction (Note 2)
- HPO = pump differential pressure at no flow and maximum pump speed and highest density as per process design (Note 3)
- HPD = hydrostatic pressure of the liquid above the pump discharge

NOTES:

1. In the exceptional case that the shut-off pressure situation and the relief situation have a common cause, the relief pressure shall be taken instead of the set pressure.
2. Consideration shall be given to the design of systems which are not liquid-full but could be filled completely within a short period, due to low vapour volume or high pump rates, against pump shut-off pressure. No rules are given in this DEP for such situations. Each case shall be studied individually and Principal's agreement is required. As a guide, operator action can be assumed within 30 minutes after an appropriate reliable warning that overfilling is taking place, see API RP 521.
3. For steam turbine and variable speed electric motor driven pumps a careful assessment of the maximum possible speed at start-up and during operation of the pump is essential, since this can influence the design pressure considerably. Differences of more than 25% between differential head at normal running speed and maximum running speed are not unusual.

4.2.1.3.4 Shell-and-tube heat exchangers

For determination of the DP of the low-pressure side of shell-and-tube heat exchangers, the "two-thirds rule" according to API RP 521 shall be considered.

Application of the rule implies that the DP of the low-pressure side equals or exceeds two-thirds of the design pressure of the high pressure side, in order to prevent the installation of a pressure relief device to protect the heat exchanger against a tube burst condition.

Another option is to establish the DP on the low-pressure side as done for other equipment (4.2.1.3.1/2/3) and to ensure adequate pressure protection.

The selection of the option shall be based on economic considerations.

The two-thirds rule shall not be applied:

- if the high-pressure side of the heat exchanger operates at 68.95 bar (ga) (1000 psig) or more, or
- if after a tube leak the DP of the low-pressure side can be exceeded for an extended period (more than 24 hours), e.g. if the high-pressure side will remain under pressure.

The effect of a tube burst on the piping and equipment connected to the low-pressure side shall be taken into account irrespective of application of the two-thirds rule.

For the design rules relating to tube burst conditions with regard to the location and size of the pressure relief device for the heat exchanger (if applicable) and/or connected piping and equipment, reference is made to API RP 521.

For more detailed information, see DEP 31.21.01.30-Gen.

4.2.1.4 Lower design pressure (LDP)

The LDP is the external design pressure or the sub-atmospheric pressure at the top of the equipment in its operating position. It is used to determine the minimum thickness of equipment parts at the design temperature.

For vapour with an atmospheric dewpoint of 0 °C or above, it shall be checked whether vacuum can develop in the equipment if the heat input to the equipment fails.

Equipment shall be designed for full vacuum if it could be subjected to sub-atmospheric pressure. If this would entail too high a cost, a lower external overpressure may be selected for the design of the equipment or a vacuum breaker may be installed. Both solutions require the Principal's approval.

Heat exchangers in steam service shall be designed for full vacuum of the steam compartment.

If due to utility failure, instrument failure, low-load conditions, maloperation, blocked-in situations or any other cause the pressure may drop below atmospheric pressure, the minimum possible pressure shall be stated in the documents for mechanical design. Steaming-out operations or Torricellian vacuum due to draining operations need not be considered since these shall be covered by adequate operating procedures.

4.2.1.5 Maximum allowable working pressure (MAWP)

The MAWP is a typical definition only used in ASME BPVC and a number of other codes referring to it. The MAWP is the maximum gauge pressure permissible at the top of the equipment in installed operating position and at a designated temperature.

For new designs the MAWP is equal to the DP.

For existing equipment, the MAWP is often re-calculated in order to allow a higher operating pressure resulting from process modifications.

4.2.2 Pressures in design of relief systems / devices

4.2.2.1 Set pressure (SP)

The SP is the inlet pressure in bar (ga) at which a pressure relief valve is set to open under service conditions.

For new construction projects the SP is generally equal to the DP and MAWP of the equipment installed in the system protected by the pressure relief valve.

In existing installations protected by a pressure relief valve the operating pressure may be increased by raising the set pressure to the MAWP of the equipment and piping installed.

If more than one pressure relief valve is required for capacity reasons, the valves may be set at different pressures to ensure stable operation, see DEP 80.45.10.10-Gen.

4.2.2.2 Overpressure

Overpressure is the pressure increase over the set pressure of a pressure relief device (see 4.2.2.1) during discharge and is usually expressed as a percentage of the set pressure.

4.2.2.3 Accumulation

Accumulation is the pressure increase over the DP/MAWP of equipment during discharge through the protecting pressure relief valve and is usually expressed as a percentage of the DP/MAWP.

Accumulation equals overpressure only when the pressure drop over the line connection between equipment and relief valve is negligible and the relief valve is set at the DP/MAWP of the equipment. The maximum allowable accumulation is prescribed by the design/construction codes for operations and fire contingencies or by the local/national regulations.

4.2.2.4 Relief pressure (RP)

The RP is the sum of the SP of a pressure relief device and the overpressure.

4.2.2.5 Blow-down

Blow-down is the difference between the SP and the reseating pressure of a pressure relief valve, expressed as a percentage of the SP.

4.2.2.6 Specified minimum bursting pressure ($S_{min}BP$)

The $S_{min}BP$ is the lowest differential pressure at the coincident temperature at which the bursting disk is allowed to burst, taking into account operating conditions like pressure pulsations, vacuum conditions, variable back-pressure, etc.

4.2.2.7 Specified maximum bursting pressure ($S_{max}BP$)

The $S_{max}BP$ is the highest differential pressure at the coincident temperature at which the bursting disk is designed to burst.

4.2.2.8 Nominal bursting pressure (NBP)

The NBP is the arithmetic average value of the $S_{min}BP$ and the $S_{max}BP$.

The NBP and the bursting pressure range are important factors in determining the DP of the equipment. Therefore, when establishing the DP, expert advice shall be sought. Other factors may influence the DP, e.g. the bursting disk line-up, single or double disks and a disk in series with a pressure relief valve. In the latter case a pressure indicator alarm should be installed between the bursting disk and the relief valve.

4.2.2.9 Back-pressure (BP)

BP is the pressure that exists at the outlet of a pressure relief device as a result of the pressure in the system downstream of the pressure relief device.

4.2.2.10 Built-up back-pressure (BBP)

The BBP is the increase in pressure in the discharge system that develops as a result of flow after the pressure relief device opens.

4.2.2.11 Superimposed back-pressure (SBP)

The SBP is the static pressure that exists against the outlet of a safety/relief device at the time the device is required to operate. SBP in the discharge system is the result of pressure caused by releases from other sources.

The above-mentioned back-pressures (BP, BBP and SBP) shall not exceed the limits which may affect proper operation of the relief device, e.g. flow performance and opening pressure.

For information on back-pressures, see API RP 520, API RP 521 and DEP 80.45.10.10-Gen.

5. REFERENCES

Amended per Circular 06/97

In this DEP reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP publications and stand specifications	DEP 00.00.05.05-Gen.
Liquefied petroleum gases - bulk storage installations	DEP 30.06.10.12-Gen.
Metallic materials - prevention of brittle fracture	DEP 30.10.02.31-Gen.
Shell-and-tube heat exchangers (Amendments/Supplements to TEMA Standards)	DEP 31.21.01.30-Gen.
Centrifugal compressors (Amendments/Supplements to API Standard 617)	DEP 31.29.40.30-Gen.
Reciprocating compressors (Amendments/Supplements to API Standard 618)	DEP 31.29.40.31-Gen.
Rotary-type positive displacement compressors (Amendments/Supplements to API Standard 619)	DEP 31.29.40.32-Gen.
Packaged, integrally geared, centrifugal plant and instrument air compressors (Amendments/Supplements to API Standard 672)	DEP 31.29.40.33-Gen.
Pressure relief and flare systems	DEP 80.45.10.10-Gen.
Requirements for fire protection in onshore oil and gas processing and petrochemical installations	DEP 80.47.10.30-Gen.
Dust explosions, Memorandum	CMFE 115/84

AMERICAN STANDARDS

Centrifugal Compressors for General Refinery Services	API Std 617
Reciprocating Compressors for General Refinery Services	API Std 618
Rotary-Type Positive Displacement Compressors for General Refinery Services	API Std 619
Packaged, Integrally Geared, Centrifugal Plant and Instrument Air Compressors for General Refinery Services	API Std 672
Sizing, Selection and Installation of Pressure Relieving Devices in Refineries, Part I and Part II	API RP 520
Guide for Pressure-Relieving and Depressuring Systems	API RP 521

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