

GENERAL SAFETY INSTRUCTIONS APPLYING TO ALL EQUIPMENT

Fifteen General Safety Instruction Sheets cite the hazards that exist in the operation and maintenance of equipment and give recommendations for avoiding hazards and for inspections and tests. The first three sheets apply generally to all equipment. Additional hazards and recommendations that are peculiar to a class or type of equipment are given on the following sheets (4 to 15) applying to the more important classifications of equipment. Particularly significant or unusual hazards, recommendations, inspections or testing to a specific item of equipment should be given on the Safety Instruction Sheet made out for that particular item.

HAZARDS

The general hazards to be considered in the operation of all process plant include:

Unsafe condition due to defects existing in equipment as built or as repaired.

Unsafe condition of equipment due to operation at pressure, temperature, speed, minimum thickness, or other condition in excess of the established safe limits.

Unsafe condition resulting from corrosion (internal or external) reducing thickness below the minimum allowable limit. This may occur from direct attack or result from failure of protective linings.

Cracking or deterioration caused by caustic embrittlement, hydrogen attack, intergranular corrosion, or stress-corrosion.

Fatigue failures occasioned by vibration or repeated stress.

Reduction of strength, of ductility, or of impact resistance, and/or the setting up of high residual stress as a result of improper welding or heating operations.

Unsafe condition or failure due to thermal stresses occasioned by exceeding established limiting rates of temperature change - during heating, cooling, or operating cycles.

Excessive strain or failure at rigid connections due to heating of lines or equipment above design temperatures for which expansion provision is made.

Unsafe condition or failure of reciprocating or rotating machines, or motors due to operation at speeds or overloads in excess of design limits.

Failure, inadequacy or blocking-off of excess pressure relieving equipment, or other automatic safety devices.

Excessive pressure caused by thermal expansion of liquid in filled lines, vessels, pumps, containers, etc. - "sun pressure".

Damage to equipment caused by testing at pressures in excess of established limits, testing at too low temperatures, or from excess loading due to weight of testing medium.

Release of flammable, poisonous, or corrosive gases or liquids due to failure of equipment from any cause.

3. ACCOUNTING
REQUIREMENTS

4. DESIGN
CONDITIONS

CHEV B8 6417

GENERAL SAFETY INSTRUCTIONS APPLYING TO ALL EQUIPMENT
HAZARDS (Cont'd.)

Leakage at threaded or gasketed joints, or at packing glands of pumps, compressors, valves, level controls and instruments.

Opening of relief valves that are not equipped with discharge conduits leading to a safe location.

Explosive mixtures in equipment caused by the failure of control valves, nonoperated valves, cycle timers, etc.

Collapse of towers, columns, stacks, tanks, etc. under wind or earth loading due to corrosion below minimum safe thickness or deterioration of foundations, supports, or guys.

Collapse of equipment due to external pressure loading in excess of design limits of pressure, thickness or roundness.

RECOMMENDATIONS FOR AVOIDING HAZARDS

Do not exceed the safe limits for any equipment in operation, cleaning or maintenance as given in:

The Safety Instruction Sheets.

Operating Standards and applicable Standing Orders.

Refinery and Engineering Instructions.

Codes and Standards authorized for refinery use, and
Mandatory State Safety Orders.

Advise the Engineering Division - Design Engineer, Maintenance Foreman, Equipment Inspector as the case may require, whenever there is any question as to the safety of equipment, or danger of exceeding established safe limits.

Require inspection of all critical repairs and new equipment installation.

Check the mechanical condition and functioning of instruments and control equipment at regular intervals as required to assure dependable and safe operation.

Consult the Engineering Division before changing any established safe limits for the operation of equipment.

INSPECTIONS

Maintain adequate periodic inspection of equipment in accordance with:

The Equipment Inspection Schedule for the plant; or in lieu of such schedule, as recommended in the Safety Instruction Sheets.

Requirements of State Safety Orders for periodic inspection of boilers, air pressure tanks, elevators and mechanical equipment.

3. ACCO. ING
REQUIREMENTS

4. SIGN
CONDITIONS

CHEV B8 6418

GENERAL SAFETY INSTRUCTIONS APPLYING TO ALL EQUIPMENT
INSPECTIONS (Cont'd.)

See that adequate maintenance schedules are established and followed for the servicing and inspection of:

- a. Electrical equipment - motors and controls; power circuits; lighting service; control systems; and signals and alarms,
- b. Mechanical equipment - pumps, turbines, compressors, etc., and their governors and protective devices.
- c. Instruments and control equipment, particularly those which are vital to controlling operation within established safe limits.

During initial operation of equipment maintain close inspection of:

- a. Effects of thermal expansion on line systems, and lines stairs and ladders connecting to hot vessels for restricted movement, interference, or evidence of excessive strain.
- b. Bearings, shaft packing, and governors on mechanical equipment.
- c. Electrical equipment for overloads, heating, sources of ignition, and for proper functioning of controls, alarms, and protective devices.

TESTS

1. Test all equipment after any major repair affecting the strength of the equipment.
2. Test certain equipment, as fired heater coils, at specified intervals as called for in the Equipment Inspection Schedules or as specifically recommended in the Safety Instruction Sheets.
3. The test pressure for routine field tests of equipment shall be as given in the Safety Instruction Sheets.
4. Hydrostatic testing procedure shall conform to Engineering Instruction 300 and 301 or as given on special Hydrostatic Test Schedules prepared for particular installations.
5. Consult the Engineering Division before applying any pneumatic test.
6. Actual tests applied during shop fabrication or field construction are given on the Safety Instruction Sheets or on Hydrostatic Test Schedules prepared to cover initial testing.
7. Remove, test and reset safety or relief valves protecting the equipment at frequencies given in the Equipment Inspection Schedule for the plant, or in lieu of such a schedule as recommended on the Safety Instruction Sheets.

3. ACCOUNT
REQUIREMENTS

4. DES.
CONDITIONS

GENERAL SAFETY INSTRUCTIONS APPLYING TO PROCESS LINES

HAZARDS

The hazards that are particularly to be considered in the operation of process lines, include:

1. Those hazards listed in the General Safety Instructions Applying to All Equipment which apply to piping systems.
2. Hydraulic shock from rapid closing of valves.
3. Excessive vibration or repeated strain leading to fatigue failure.
4. Exceeding design limits for expansion or anchorage of lines or alteration of supports, anchors, tie rods, hangar adjustments, initial "cold pull", etc.
5. Failure of gaskets or packing due to deterioration, corrosion or exceeding pressure or temperature limits for the packing material.
6. Leakage or failure due to external corrosion - both general and localized conditions, and particularly buried lines - electrolysis and soil corrosion.
7. Breakage of threaded piping especially small sizes due to mechanical strains, thermal expansion, operating valves, etc.
8. Excessive stress in welded piping at supports, mitre welds, tee intersections, etc. leading to opening of cracks. Particularly important in lines: with high internal pressure; subject to severe thermal expansion strains; in low temperature service; hot caustic service; or of alloy steel materials.
9. Internal combustion or explosions in lines.
10. Fire hazard from ignition of flammable materials (timber, paper insulation sheathing, etc.) located too close to high temperature lines.
11. Release of flammable, poisonous or corrosive liquids or vapors due to relaxation of flange bolts at high temperatures or sudden temperature change of flanged joints, or corrosion or erosion of pyrometer or thermometer wells in lines.

RECOMMENDATIONS FOR AVOIDING HAZARDS

1. Note recommendations in the General Instructions Applying to All Equipment.
2. Warm up lines gradually and avoid sudden temperature change except in an emergency.
3. Maintain supports, anchorages, spring hangars, tie rods, etc. in proper condition and with specified adjustments. Consult Engineering Division before altering supports or adjustments.

GENERAL SAFETY INSTRUCTIONS APPLYING TO PROCESS LINES
RECOMMENDATIONS FOR AVOIDING HAZARDS (Cont'd.)

Do not block off sections full of liquid without venting or draining.
Protect dead ends or idle lines against freezing by insulating, draining,
or by maintaining flow.

Replace installed pipe and fittings in kind, or in accordance with
Materials Standard No. 319, or per recommendations of the Engineering
Division.

Test out before reconnecting dead or idle lines, particularly if buried.

Protect lines against mechanical strains during maintenance operations.

Protect 18-8 Cr. Ni. and 18-8-3 Cr. Ni. Mo. material against intergranu-
lar corrosion during idle periods. Refer to Recommended Practice No. 124.

Observe all precautions given in Engineering Instructions on maintenance
and installation practice including: No. 800 - Bolting Up Practice;
No. 810 - Fitting Up Fabricated Pipe; No. 506 - Installing Gaskets;
No. 656 - Breaking Lines.

Observe all precautions given in Engineering Instructions covering weld-
ing practice and requirements for stress relief, annealing or heat treat-
ing welded piping - both steel and alloy.

Unless otherwise stated, maximum allowable operating pressures and tem-
peratures for new lines should conform to Materials Standard No. 319 for
the particular class of fitting and service. The ratings given therein
are based on the A.S.A. Standards and Piping Code.

Where not specifically given, the minimum safe thicknesses for steel pipe
and commercial sizes of A.S.A. steel fittings, can be determined from
minimum thickness charts: MF-4026, steel lines; MF-4639, steel fittings;
E-4640 low alloy fittings; and MF-4641, 18-8 Cr. Ni. fittings.

INSPECTIONS AND TESTS

Refer to General Safety Instructions Applying to All Equipment.

Unless otherwise specified, the test pressures for separable piping sec-
tions shall be in conformance with the A.S.A. Pressure Piping Code;

150 lb. steel fitted lines shall be tested at 350 psi.

300 lb. steel fitted lines shall be tested at 750 psi.

Safe test pressures for lines may be limited by reduced thickness
(corrosion), special fittings (as control valves, expansion joints,
etc.), and pressure test limits for connected equipment where lines
cannot be isolated. Refer to sheet on Hydrostatic Test Pressures
supplementing Engineering Instruction No. 300.

Consult Engineering Division for proper test pressure and procedure in
event of any question.

GENERAL SAFETY INSTRUCTIONS FOR FIRED HEATERS

HAZARDS

The hazards to fired heater installations in operation, include:

Those general hazards listed in the General Safety Instructions Applying to All Equipment which apply to fired heater installations.

Excessive tube temperatures resulting in damage to, or failure of, tubes. Excessive temperatures may be caused by coke or other deposits, by excessive firing rates or by uneven heat distribution.

Excessive pressures caused by stoppage or restricted flow due to obstructions or coke formation in the heating element or transfer lines. Cores, collapsed liners, pass or outlet control valves, may cause restricted flow.

Excessive pressures due to failure, plugging or coking of relief valves.

Failure or loosening of rolled joints or of tube seal welds due to repeated cycles of temperature change, or to sudden changes in temperature, or to improper use of dissimilar metals in rolled joints or in adjacent tube positions.

Leakage or opening of header plugs due to damaged seats, or to breakage, loss of strength or excessive wear of screws and holding members, or to insecurely seated plugs.

Damage or actual rupture of parts involved in flashes from leakage of stills or plugs.

Explosions in firebox from ignition of explosive fuel-air mixtures or interruption of gas fuel flow.

Structural failure from overheating or deterioration of tube supports, supporting steel structures, breechings, stacks, internal insulation, etc.

Damage to tubes, particularly alloy tubes, by abuse in cleaning, by continued service at excessive temperatures or by too rapid cooling.

Corrosion or oxidation of exterior tube surfaces by furnace gases in operation; and corrosion - inside or outside - by residual salts and moisture during idle periods, including intergranular corrosion of 18-8 Cr. Ni. material.

In shell stills: overheating of fire sheet, excessive vacuum, corrosion of still bottom, deterioration of still supports, or excessive pressure or "bumping" from water in still.

GENERAL SAFETY INSTRUCTIONS FOR FIRED HEATERS

RECOMMENDATIONS FOR AVOIDING HAZARDS

Observe recommendations given in the General Safety Instructions Applying to All Equipment.

Proper firing control is the most important factor in avoiding conditions leading to tube failure. Avoid flame impingement on tubes, excessive flame length, distorted flames from dirty or faulty burners, or uneven heat distribution with multiple burners. Maintain proper combustion control. Visually check fires and heated surfaces at regular and frequent intervals.

Take all precautions to prevent sudden change or stoppage of flow through tubes. Maintain cores, check valves, outlet and pass control valves in dependable condition. Pass control valves must be set to assure positive and balanced flow at all times.

Observe all precautions given in Engineering Instructions on heater maintenance and specialities including those covering: Tube cleaning, Heading Up, Bolting-up Practice, Tube Rolling and Removal, Skin Point Installation, Safe Ending and Seal Welding Tubes; and those covering Welding and Heat Treatment of both steel and alloy materials.

INSPECTIONS AND TESTS

See recommendations given on sheet - General Safety Instructions Applying to All Equipment.

Make periodic inspections for corrosion or deterioration. Make special inspections for possible damage after fires, flashes, or local overheating - particularly where alloy materials are involved.

Apply hydrostatic leakage tests as required. Apply hydrostatic strength tests at specified regular intervals, and after any tube rolling or strength welding. Observe precautions given in Engineering Instruction No. 300 - Hydrostatic Testing, including supplementary sheet on Hydrostatic Test Pressures, and No. 301 - Hydrostatic Testing of Tube and Header Installation.

Consult Engineering Division for proper test pressure and procedure in event of any question on pressure testing.

3. ACCOUNTING
REQUIREMENTS

4. DESIGN
CONDITIONS

GENERAL SAFETY INSTRUCTIONS FOR HEAT TRANSFER EQUIPMENT

HAZARDS

The hazards to heat exchange equipment in operation include:

Those general hazards listed in the General Safety Instructions Applying to All Equipment which apply to heat exchange units.

Excessive pressures on tube or shell side, as from:

- a. Fouling or plugging of tubes, of shell passes, or of relief valves.
- b. Leakage from high pressure into low pressure side.
- c. Failure of cooling medium circulation or of heating medium controls.
- d. Thermal expansion of liquid if closed off when filled, due to heating from opposite side, or to "sun pressure."

Temperatures in excess of limits set by: cast iron construction, non-ferrous tube bundles, packed or gasketed joints, shells protected by internal insulation.

Excessive temperature difference or excessive rate of temperature change causing high stresses, deformation of tube bundle or loosening of rolled tubes. These may occur from interruption or failure of cooling medium flow, heating without cooling medium circulation, or loss of liquid level where bundles are designed to operate immersed.

Excessive pressures or temperatures caused by failure of automatic control equipment.

Excessive corrosion by the fluids handled and particularly in the case of:

- a. Excessive salt water temperatures (above 120°F.) with brass (admiralty) tubes.
- b. Oxygen or carbon dioxide released in steam reboilers or preheaters.
- c. Electrolytic corrosion at contacts of dissimilar metals, including metal gaskets.
- d. Effects of neutralizing or treating agents, ammonia, caustic, chlorine, etc., on non-ferrous materials.
- e. Caustic embrittlement of steel, hydrogen attack in steel at high temperatures, intergranular and stress corrosion of 18-8 Cr. Ni.

Corrosive influences must be considered not only during operation but also while units are shutdown and during chemical cleaning.

Hazards occasioned by internal leakage such as: contamination of stock of treated cooling water; chemical reactions between hot and cold fluids, if mixed; entrance of water into dry feed stocks to high temperature equipment; or the release of flammable or poisonous vapors or gases through the water conduits to cooling towers or sewers. Also release of hydrogen sulfide gas in chemical cleaning operations.

GENERAL SAFETY INSTRUCTIONS FOR HEAT TRANSFER EQUIPMENT

RECOMMENDATIONS FOR AVOIDING HAZARDS

Observe recommendations on sheet - General Safety Instructions Applying to All Equipment.

In initial operation check closely for free expansion at supports, expansion joints and connected piping.

Maintain close watch on instruments and controls regulating operating conditions.

Have cold medium circulating before starting hot side flow.

Avoid excessive rates of temperature change or thermal "shock".

Do not vent unprotected units when idle and closed off.

Maintain requisite pH control on cooling tower water, steam reboiler and heater condensate, and on overhead streams to check neutralizing.

Salt water outlet temperatures should not exceed 120°F. for brass (Admiralty metal) tubes.

Clean, flush, or neutralize shutdown units as necessary to prevent damage when steaming out or standing idle. Whenever possible salt water cooled units should be flushed with fresh water before steaming out, to prevent rapid dezincification.

INSPECTIONS AND TESTS

See general recommendations given on sheet - General Safety Instructions Applying to All Equipment.

Make inspections for corrosion of all exposed parts whenever tube head or shell cover (and floating head) are opened.

Make complete inspection of unit, including gage measurements of shell thickness - if required, whenever a unit is retubed.

Apply specified test pressure after repairs to tube bundle or shell.

Apply at least water system pressure test to bundle after replacing floating head to check fit and gaskets before replacing shell cover head.

Consult Engineering Division for proper test pressure and procedure in event of any question on pressure testing.

3. ACCOUNTING
REQUIREMENTS

4. DESIGN
CONDITIONS

GENERAL SAFETY INSTRUCTIONS FOR PRESSURE VESSELS

HAZARDS

The hazards to pressure vessel equipment include:

Those general hazards listed in the General Safety Instructions Applying to All Equipment which apply in the case of pressure vessels.

Failure, plugging, isolation from, or too high settings of pressure relief valves, resulting in excessive pressure.

Failure of regulating or control equipment, resulting in excessive pressure or temperature.

General reduction below minimum safe shell thickness, or local penetration, or weakening of internal bracing or structures due to: normal process corrosion or localized or accelerated attack; failure of internal protective linings; inadequate neutralizing of corrosive media; or corrosion caused by opening, purging, washing or chemical cleaning.

Weakening or failure of supports due to: wind or earth shock loads in excess of design provisions; fire exposure; corrosive leakage; temperatures in excess of design limits for strength or for free expansion; or binding or restraint of special support elements.

Collapse due to: external pressure in excess of design limits; corrosion of shell or internal bracing below safe minimum thickness for external pressure loading; or out-of-roundness in excess of safe limits for external pressure. Also damage to internal linings, especially lead linings, due to external pressure loading.

Release of hot, flammable, corrosive, or poisonous liquids or gases in event of rupture or cracking; or leakage from fitted or packed joints, riveted joints, gage glass breakage; or in draining or opening vessels.

Thermal stresses at localized points caused by too rapid rates of temperature change, or too great temperature differences, especially in thick wall vessels, glass or brick lined, or packed vessels.

Cracking or deformation at supports, at line connections; or at shell attachments, caused by: repeated loading or vibration; differential expansion of connected lines or structures; or by over-loading davits or brackets.

Shock loading: as by sudden stoppage of flow through filled vessels (hydraulic shock); or by internal explosions; or by external impact loads - particularly in the cases of vessels in low temperature service or of cast iron construction.

Thermal expansion of contents if closed off too full; or freezing of contained water, especially in drains and connections.

3. ACCOUNTS
REQUIRED

4. DE
CC
ITIONS

CHEV B8 6426

GENERAL SAFETY INSTRUCTIONS FOR PRESSURE VESSELS

HAZARDS (Cont'd.)

Admission of water or trapping or pocketing of water in hot equipment causing violent pressure surges as "Blows" in columns.

Failure of internal insulating linings or of "vapor stops" in insulation, causing excessive shell temperature and/or corrosion.

Embrittlement and cracking: as by hydrogen attack if metal temperatures exceed safe limits; or by caustic embrittlement, especially if not stress-relieved.

Chemical reactions - inherent in process or accidental - causing excessive pressures, temperatures, or corrosion.

Cracking, embrittlement, or residual stress caused by unauthorized heating or welding, particularly on high tensile or alloy steel or stress-relieved vessels.

RECOMMENDATIONS FOR AVOIDING HAZARDS

Observe general recommendations on sheet - General Safety Instructions Applying to All Equipment.

Inspect hot vessels during initial warm-up, for restricted movement or evidence of strain particularly at supports and connected lines or structures.

Maintain close observation of instruments and controls regulating operating conditions and those indicating shell metal temperatures. Take additional temperature readings in critical areas where there is any danger of exceeding safe temperature limits.

Observe all precautions necessary to safeguard against accidental blocking of safety or relief valves or of blow-off lines from relief valves, especially where three-way valves, locked-open valves, or bursting discs are installed under relief valves.

Avoid excessive external pressure in operation; or in steaming out, in emptying contents, or in testing.

Observe all precautions given in Engineering Instructions on vessel construction, maintenance, and repair including those covering: Design, Alteration, Repairs, and Inspections of Vessels (No. 103); Installing Alloy Linings (No. 501); Handling Compressed Gas Cylinders (No. 404); Repair Welds in Vessel Shells (No. 650); Cleaning Vessels (No. 663); Bolting Up Practice (No. 800); and all those covering Welding, Heat Treatment and Stress-Relieving Practice for both steel and special alloy materials.

Consult the Engineering Division in regard to any repairs or alterations to pressure vessel equipment.

3. ACCOUNTING
REQUIREMENT
4. DESIGN
CONDITIONS

GENERAL SAFETY INSTRUCTIONS FOR PRESSURE VESSELS

INSPECTIONS AND TESTS

See general recommendations given on sheet - General Safety Instructions Applying to All Equipment.

Make regular periodic inspection of all pressure vessels in the manner prescribed in the Equipment Inspection Manual and at frequencies as given in the Equipment Inspection Schedule for the plant, or in lieu of such a schedule as recommended on the Safety Instruction Sheets. Pressure Tanks in California must be inspected biennially under the State Safety Orders.

Make special inspections for possible damage after any instance of fires, flashes, overheating or excessive pressure.

Test vessels to routine test pressures given on the Data Sheets, after any major repair or welding affecting the strength of the equipment. Observe precautions given in Engineering Instruction No. 300 - Hydrostatic Testing, including supplementary sheet on Hydrostatic Test Pressures.

Consult Engineering Division for proper test pressure and procedure: in event of any question on pressure testing; in any case of pneumatic testing; and in any case of test of spheres or spheroids.

3. ACCOL. ING
REQUIREMENTS

4. IGN
CONDITIONS

GENERAL SAFETY INSTRUCTIONS FOR MECHANICAL EQUIPMENT

HAZARDS

The hazards to mechanical equipment in operation, include:

Those general hazards given in the General Instructions Applying to All Equipment which apply to the type of mechanical equipment considered.

Excessive pressures: in pumps caused by discharge shut-off, excessive suction pressure, or excessive speed, particularly in series operation of pumps, or in testing; in compressor cylinders caused by discharge shut-off, excessive intake pressure or blocked-off jacket water circulation; and in turbine cases caused by a closed exhaust.

Shock and/or excessive pressure: in reciprocating pumps or engines due to wet steam or failure to drain in starting, particularly in flywheel engines; and in compressors from liquid entering cylinders with the gas.

Distortion or failure of parts and damage to bearings caused by overload-
ing as due to operation of machines or motors in excess of design capacity or speed; or to abnormal variation of compressor intake pressure.

Damage to turbine or compressor blading caused by: water in steam; erosion by solids in the fluids; excessive temperatures; and by corrosion during shutdown periods.

Excessive speeds caused by malfunctioning or failure of governors speed controllers or overspeed trips or failure of couplings resulting in runaway and "explosion" of driver, flywheel, or driven machine.

Excessive vibration leading to fatigue failure of parts and of connected lines - especially small threaded connections - caused by improper foundations, poor alignment, or improper balancing of rotating elements.

Excessive temperatures of steam or fluids handled causing: distortion or failure of cases or parts due to reduced strength of the material above the design temperature limit; reduced clearances or running fits leading to excessive wear or seizing; irregular expansion and misalignment leading to vibration, interference, bearing or packing failure, or shearing of gaskets or anchor bolts; deterioration and excessive scaling in water jackets and cooling systems. Steaming out equipment which normally operates at lower temperature may cause expansion strains on pump flanges, castings, etc., resulting in failure or misalignment.

Excessive temperatures not due to process heat, caused by: mechanical difficulties such as interference of loose parts or misalignment; overloading bearings; presence of foreign material; failure of cooling systems; and loss or contamination of lubricant to bearings.

Thermal shocks leading to cracking of case parts - particularly irregularly shaped castings and cast iron parts - due to sudden temperature changes, or too rapid starting from cold or in cutting-in standby units, or too rapid cyclic changes.

GENERAL SAFETY INSTRUCTIONS FOR MECHANICAL EQUIPMENT

HAZARDS (Cont'd.)

Overheating and scoring or seizing of close clearance parts in centrifugal or rotary pumps if operated on other than the designated fluid or at low throughput due to shutoff or bypassing to the suction.

Excessive temperatures in motors leading to damage to windings and possible fire hazard caused by improper bearing adjustment or lubrication, overloads, shorting, or obstruction of ventilation. Motor overloads may result from pumps designed for low gravity oils being operated on higher gravity stocks or water.

Corrosion or damage to insulation and shorting of motor windings by moisture, chemical leakage, dirt, or excessive lubrication.

Direct release of hot, flammable, corrosive or poisonous liquids or gases in the event of gasket, thread, or packing leakage, or actual failure of case or connections.

Source of ignition hazards such as dragging gland followers on pumps, electrostatic charges on belts, defective gas engine exhausts, and explosion hazards in gas engine crank cases and starting air systems.

RECOMMENDATIONS FOR AVOIDING HAZARDS

Observe recommendations on sheet - General Safety Instructions Applying to All Equipment.

Provide for adequate "running in", and close observation in initial operation for strains, vibration, misalignment, bearing temperature, packing gland adjustment, functioning of sealing, cooling and lubricating systems and of governors and overspeed trips. Take precautions against foreign material entering wearing parts and bearings. Observe precautions in Engineering Instruction No. 600 - Installing Pumps.

Maintain close attention in service to functioning and condition of all instruments, regulating equipment, governors, automatic cutouts, protective devices, and relief valves which serve to control operating conditions within safe limits.

Avoid losing suction or sudden shutoff against pumps, particularly positive displacement types. Check series or tandem combinations to prevent excessive pressure on the second pump.

Bleed steam supply lines and drains on pumps, engines, and turbines and open exhaust valves before admitting live steam. Warm up any hot service equipment slowly when putting it in operation.

GENERAL SAFETY INSTRUCTION SHEET

Mechanical Equipment - Pumps, Compressors, and Drivers

ME-5102
Sheet 14

545

3. ACCOUNTING
REQUIREMENTS

4. DESIGN
CONDITIONS

CHEV B8 6430

GENERAL SAFETY INSTRUCTIONS FOR MECHANICAL EQUIPMENT

RECOMMENDATIONS FOR AVOIDING HAZARDS (Cont'd.)

Follow safe practices for operation and lubrication of equipment as given in the Operating Standards including 9091 - Lubricants for Refinery Equipment, 9421 - Operation of Reciprocating Pumps, and 9422 - Operation of Centrifugal Pumps and in the Manufacturers' Instruction Manuals for specific units.

Pay particular attention to gland adjustment, cooling water or oil circulation to glands and bearings, Duraseals, jacket water circulation, and bearing lubrication systems. Observe precautions in Engineering Instruction No. 500 - Installing Packing in Pumps and Compressors.

Keep cooling air passages in motors clean and free from obstructions. Do not operate motors without specified fuses or overload protection devices.

Turn over standby units at regular intervals as specified in Operating Standards. Check functioning of traps in steam to standby units frequently.

Observe requirements of State Safety Orders for Engines and Mechanical Power Transmission relative to guarding, clearances, access and ventilation in pump and compressor rooms.

INSPECTIONS AND TESTS

See general recommendations given in the General Safety Instructions Applying to All Equipment.

Regular periodic tests and inspections of all protective devices including test and resetting of relief valves. Relief valve set pressures to be given on the Data and Operating Limits Sheets.

Regular inspection and servicing by machine and electric shops in accordance with departmental or district maintenance schedules. Have Electrical Inspector check any explosion-proof motor that is opened before closing the case.

Inspection of critical units for corrosion, or materials by Equipment Inspectors whenever opened for maintenance, or as specifically called for in the Safety Instruction Sheets or the Equipment Inspection Schedule for the plant.

Test equipment to test pressure given on the Safety Instruction Sheets after any major repair affecting the strength of the equipment.

Consult the Engineering Division for proper test pressure and procedure in event of any question on pressure testing.

GENERAL SAFETY INSTRUCTION SHEET
Mechanical Equipment - Pumps, Compressors, and Drivers

ME-5102
Sheet 15
5-45

CHEV B8 6431

3. ACCOUNTING
REQUIREMENT.

4. DESIGN
CONDITIONS