ARTICLE KD-6
DESIGN REQUIREMENTS FOR CLOSURES, INTEGRAL HEADS,
THREADED FASTENERS, AND SEALS

KD-600 SCOPE

The requirements in this Article apply to integral heads, closures, threaded fasteners, and seals. These requirements are additional to the general requirements given in Articles KD-1 and KD-2.

KD-601 GENERAL

(a) Closures, integral heads, threaded fasteners, and seals shall have the capability to contain pressure with the same assurance against failure as the vessel for which it will be used.

(b) The Designer shall consider the influence of cross bores and other openings on the static strength integrity of the vessel.

(c) A complete stress analysis shall be made of all components that contribute to the strength and sealing capability of the closure.

(d) For applications involving cyclic loads, the requirements of Articles KD-3 or KD-4, as applicable, shall be met for all parts except the sealing element.

(e) Provisions shall be made to prevent separation of joints under all service loadings.

(f) The effects of the total load to be resisted, the number of threads, the number of threaded fasteners, the thread form, the relative stiffness of mating parts, and friction shall be considered in both the static and fatigue analyses.

(g) Vent passages shall be provided to prevent pressure buildup caused by accidental or incidental development of any secondary sealing areas exterior to the designated sealing surface (e.g., threads).

(h) Flared, flareless, and compression-type joints for tubing are not permitted. Proprietary fittings are addressed in KD-625.

KD-620 THREADED FASTENERS AND COMPONENTS

(a) Threaded fasteners are frequently described as bolts, studs, and tie rods.

(b) Straight threaded connections are permitted as provided for in this Article. Tapered pipe threads are not permitted.

(c) Where tapped holes are provided in pressure boundaries, the effect of such holes (e.g., stress riser, material loss) shall be considered in the vessel design.

(d) Thread load distribution shall be considered in design cyclic analysis in accordance with KD-622.

KD-621 ELASTIC–PLASTIC BASIS

In lieu of the requirements of KD-623(a) through KD-623(g), the Designer may use the elastic–plastic method and meet the applicable requirements of KD-230 for all threaded joints or fasteners of any thread form.

(a) The elastic–plastic rules of KD-231 are applied for all the loads and load cases to be considered as listed in Table KD-230.1 and defined in KD-231.2.

(b) The load combinations and load factors as listed in Table KD-230.4 are applied and the components are the applied loads.

KD-622 FATIGUE AND FRACTURE MECHANICS ANALYSIS

(a) A fatigue analysis in accordance with Article KD-3 or a fracture mechanics analysis in accordance with Article KD-4 is required for all threaded connections.

(b) The fatigue evaluation of a threaded joint is made by the same methods as are applied to any other structure that is subjected to cyclic loading.

(c) ASME B18.2.2 Standard nuts of materials permitted by this Division do not require fatigue analysis. Internal threads mating with a stud or bolt do not require fatigue analysis for bolting loads. However, the effects of the internally threaded penetration on the nominal primary-plus-secondary stresses in the internally threaded member shall be considered.

KD-623 LINEAR ELASTIC BASIS

Linear elastic analysis may be used under the following conditions:

(a) The number and cross-sectional area of bolts required to resist primary loads shall be determined. The yield strength values to be used are the values given in Section II, Part D for bolting materials.
Figure H-101
Straight Drill Connections for Thick-Walled Cylinders

NOTE:
(1) See KD-661(b).

See KD-661(a)
KD-660  REQUIREMENTS FOR CLOSURES AND SEALS

The requirement of a leak-tight seal is of primary importance in closures for high pressure vessels. This is because even small leaks produce a damaging (cutting) effect through the sealing surfaces, which may progress rapidly to increasingly hazardous conditions.

KD-661  REQUIREMENTS FOR CLOSURES

(a) Adequate venting shall be provided in the closure design in the event of seal failure.

(b) The effects of dilation, distortion, or both on the closure components under all expected conditions of pressure and temperature shall not result in an increase in the seal clearances greater than the values required to retain the sealing element.

KD-662  REQUIREMENTS FOR SEALING ELEMENTS

The material selected shall be compatible with all normally expected process and environmental conditions, such as pressure, temperature, corrosion, solubility, chemical reaction, etc., as specified in the User’s Design Specification.

KD-662.1  Contained Sealing Elements. The materials of construction for sealing elements are generally not covered in Part KM. The User’s Design Specification shall either specify the required material or furnish enough information to enable the Designer to make an appropriate selection.

KD-662.2  Unsupported Metallic Sealing Elements. Sealing elements which themselves provide the strength required to contain the pressure (i.e., cone joint, lapped joint, etc.) shall satisfy the requirements of this Division.