Table 4.3.4
Equivalent Line Load Applied to Large End Junction (Cont'd)

NOTE:
(1) The equation to determine $M_{SN}$ and $Q_N$ is shown below.

$M_{SN}, Q_N = - \exp \left( \frac{C_1 + C_3 \ln \left( \frac{H^2}{H} \right) + C_9 \ln \left[ \alpha \right] + C_7 \left( \ln \left( \frac{H}{H^2} \right) \right)^2 + C_9 \left( \ln \left( \alpha \right) \right)^2 + C_{11} \ln \left( \frac{H^2}{H} \right) \ln \left[ \alpha \right]}{1 + C_2 \ln \left( \frac{H^2}{H} \right) + C_4 \ln \left[ \alpha \right] + C_8 \left( \ln \left( \frac{H}{H^2} \right) \right)^2 + C_8 \left( \ln \left( \alpha \right) \right)^2 + C_{10} \ln \left( \frac{H^2}{H} \right) \ln \left[ \alpha \right]} \right)$

Notes: (1) The equation to determine $M_{SN}$ and $Q_N$ is shown below.

$M_{SN}, Q_N = - \exp \left( \frac{C_1 + C_3 \ln \left( \frac{H^2}{H} \right) + C_9 \ln \left[ \alpha \right] + C_7 \left( \ln \left( \frac{H}{H^2} \right) \right)^2 + C_9 \left( \ln \left( \alpha \right) \right)^2 + C_{11} \ln \left( \frac{H^2}{H} \right) \ln \left[ \alpha \right]}{1 + C_2 \ln \left( \frac{H^2}{H} \right) + C_4 \ln \left[ \alpha \right] + C_8 \left( \ln \left( \frac{H}{H^2} \right) \right)^2 + C_8 \left( \ln \left( \alpha \right) \right)^2 + C_{10} \ln \left( \frac{H^2}{H} \right) \ln \left[ \alpha \right]} \right)$

In the 2008 Edition of Section VIII Div 2, the terms in the equation were given as "alpha" and not "a". The error was introduced in the 2011 Edition where the "alpha" was changed to "a". This was errata since there has been no voted action to revise the table. Replace the "a" in the existing equation with "alpha".
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.

 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 per 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 methods 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 stable under 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) The stresses developed by the expected service shall be analyzed. Unless it can be shown by analysis or test that a lower value is appropriate, the fatigue strength reduction factor for threads shall not be less than 4.0.

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

(e) Provision is made to prevent separation of the joints under all service loadings.

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

(g) A prototype joint shall be subjected to performance tests to determine the safety of the joint under simulated service loadings per Article KD-12. When vibration, fatigue, cyclic conditions, low temperature, thermal expansion, or hydraulic shock is anticipated, the applicable loads shall be incorporated in the tests.

(h) 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).

(i) Flared, flareless, and compression type joints for tubing are not permitted.