APPENDIX A
TWO METHODS OF SPECIFYING EYEBOLT CAPACITIES

A1. Introduction.

Two methods are currently used in specifying the capacities of forged steel eyebolts. One is more commonly used by riggers and shop personnel, while the other is generally preferred by engineers and designers of lifting rigs. Care must be exercised in selecting and using the correct type of capacity for each application.

A2. Rigger's Capacity.

The rigger's capacity refers to the actual load a single eyebolt can lift. The allowable load varies with the angle between the leg of the lifting rig and the shank of the eyebolt. In general, it also assumes that the load to be lifted acts along the axis through the shank. (The primary exception is where the eyebolts are mounted on the sides of the load.) Rigger's capacities are most easily used when the eyebolts are mounted on the top of a uniformly distributed load. In such cases, the total load is divided by the number of eyebolts to be used for the lift in order to determine the required capacity, taking into account the angle of the legs of the rig. Figure A1 shows such an application.

By symmetry in Fig. A1, it is apparent that each eyebolt carries one-half of the total load, i.e., 500 lb in a vertical direction. Therefore, two eyebolts must be used, each having a rigger's capacity of at least 500 lb for a sling angle of 30 deg.

A3. Engineering Capacity.

The engineering capacity, on the other hand, refers to the allowable tension in the leg of the lifting rig as it is applied to the eyebolt. This type of capacity is particularly useful when the load distribution is nonuniform, requiring nonsymmetrical slings, or when the eyebolts are not placed on the top surface of the load. In such cases, the load to be lifted does not act through the shank of the eyebolt. It is necessary to determine the tension in each leg of the rig before sizing the eyebolts. Simply dividing the total load by the number of eyebolts to be used may give erroneous and unsafe results. Figure A2 shows such an application.

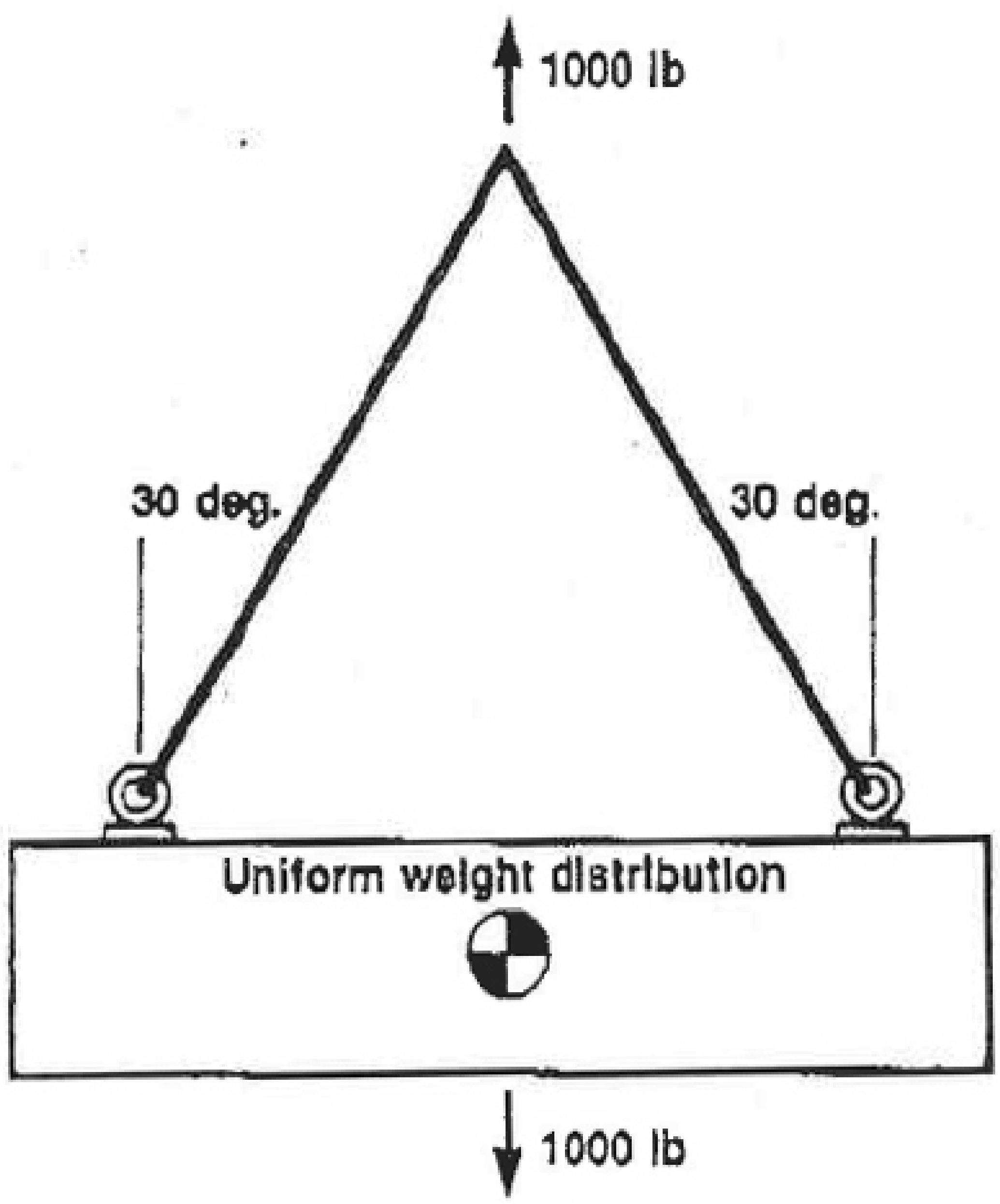

FIG. A1 UNIFORM WEIGHT DISTRIBUTION

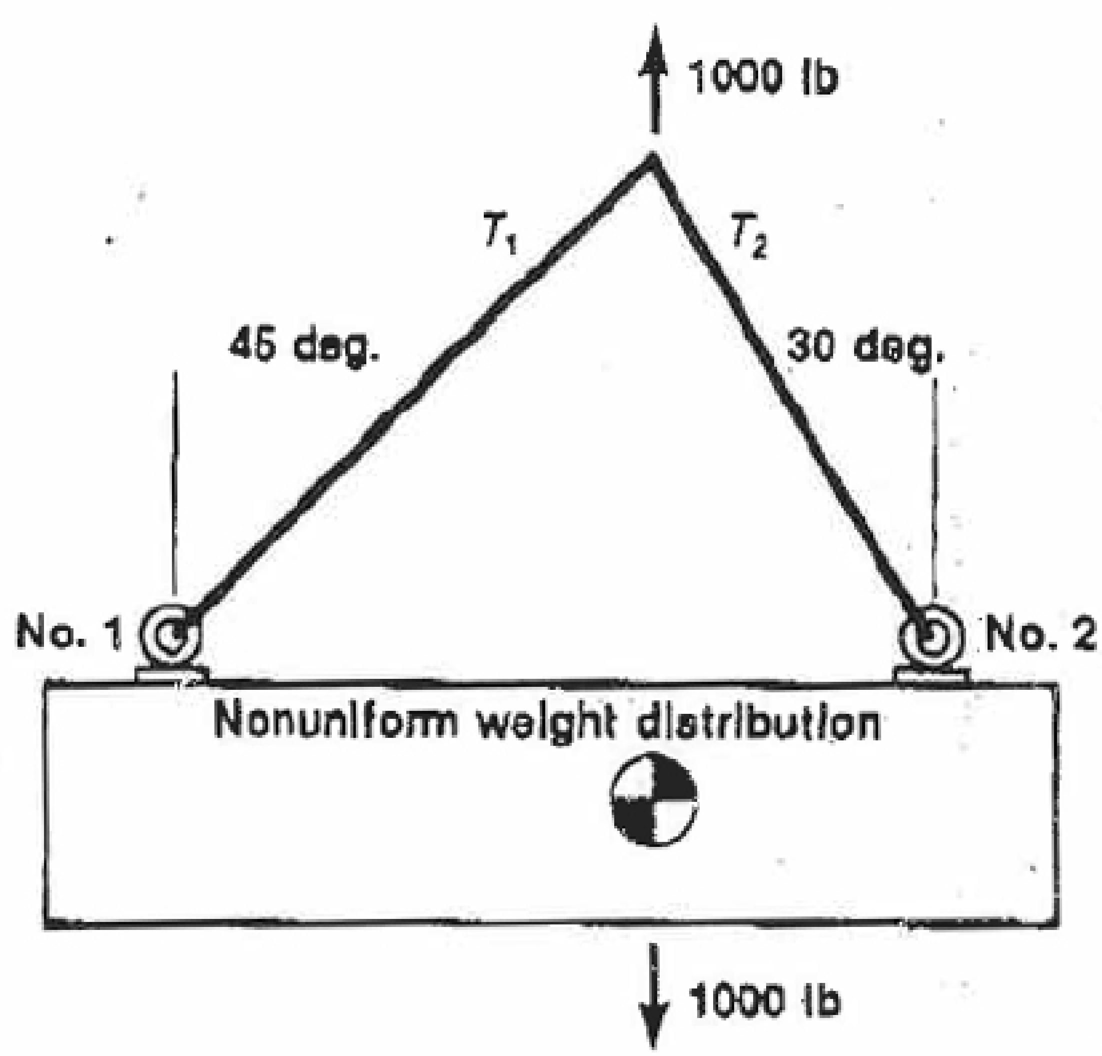

FIG. A2 NONUNIFORM WEIGHT DISTRIBUTION

In Fig. A2,

$$T_1 \sin 45 = T_2 \sin 30$$

Thus,

$$T_1 = T_2 \frac{\sin 30}{\sin 45}$$

Also,

$$T_1 \cos 45 + T_2 \cos 30 = 1000$$

Substituting for T_1 yields

$$T_2 \frac{\cos 45}{\sin 45} \sin 30 + T_2 \cos 30 = 1000$$

$$T_2 = \frac{1000}{\frac{\sin 30}{\tan 45} + \cos 30}$$

Thus,

$$T_2 = 732.05 \text{ lb}$$

Substitution yields

$$T_1 = 732.05 \frac{\sin 30}{\sin 45}$$

$$T_1 = 517.64 \text{ lb}$$

Thus, eyebolt No. 1 requires an engineering capacity of at least 518 lb for an angle of 45 deg., while eyebolt No. 2 requires an engineering capacity of at least 732 lb for an angle of 30 deg.

APPENDIX B
CAUTIONS AND DEFINITIONS

B1. Altering of Eyebolts.

Eyebolts should never be ground, notched, undercut, or welded. Such alterations will weaken the eyebolt. Eyebolts showing signs of having been so altered should immediately be destroyed.

B2. Extreme Heat.

Eyebolts should never be subjected to heat in excess of 900°F (480°C). Important physical properties are likely to be changed by such heating, creating an unsafe bolt. Eyebolts having been subjected to such heating should be immediately destroyed.

B3. How To Destroy.

Eyebolts that are being removed from service should be rendered unusable. Crushing or cutting clear across the eye is recommended.

B4. Always Stand Clear.

Never stand, work, or crawl under the load. If the load could swing, or if the pieces could fly in the event of a drop, allow for this possibility by establishing a safe distance from the load.

B5. Elongation and Bending.

Any visible bending or elongation of the eyebolt is a danger signal and indicates that it has been stressed beyond rated capacity. The bolt should be removed, destroyed, and the application investigated.

B6. Definition of Rated Capacity.

Rated capacity is the maximum recommended load that should be exerted on the item. All rated capacities, unless otherwise noted, are for in-line pull with respect to the center line of the item.

B7. Definition of Safety Factor.

Safety factor is an industry term denoting theoretical reserve capacity. It is usually computed by dividing the catalog stated ultimate load by the catalog stated working load limit and generally expressed as a ratio, for example, 5 to 1.