degree of fit that can reasonably be expected in the field. The following procedures are designed to accomplish this. Deflation or tools not furnished by the device or vehicle manufacturer are not allowed. Before installing, lay the traction device flat and remove any twists or kinks.

3.1 Traction Devices with Incremental Adjustment—Traction devices with incremental adjustment should be installed in accordance with the manufacturer's instructions, driven 0.1 km or more, and adjusted as tightly as possible. When this *full tight* condition is obtained, each side member shall be loosened one increment to the *one link loose* configuration. The test is conducted at this *one link loose* condition Side member assymmetry should be a maximum of one increment with the looser member on the outside of the tire. Dangling ends should be secured to the side members or handled per manufacturer's instructions.

3.2 Traction Devices with Infinitesimal Adjustment—In accordance with manufacturer's instructions, center the cross members on the tire with equal drape on each shoulder making sure that each cross member is lying flat. Close the fasteners and take up all slack. Drive 0.1 km or more and retighten.

4. Data Analysis

4.1 Photographic Method—A stop motion film analyser provides a convenient method of analyzing the results. Picture image size should be set to some easy ratio with the real scales, such as 1.1 Then the tire profile is traced and the maximum tire chain dynamic profile laid in per Fig. 1. It is then easy to determine if any of the chain profiles penetrate the maximum permissible profile by overlaying the tracing on the screen and stepping the film slowly to examine each frame.

4.2 Rigid Foam Method—The rigid foam can be traced on paper and compared with a tracing of the base tire tested under the same conditions. Measurement should be made as soon as possible after foam is sculpted to insure accuracy. (Foam may have dimensional instability.)

5. Classification—A target profile is constructed according to Fig. 1. (NOTE: Maximum permissible profiles are presented in table on Fig. 1.) Traction devices may be labeled "SAE Class _____" if they meet the following profile requirements at 70 km/h in a straight path.

SAE Class S—Traction devices that do not penetrate Profile S.

SAE Class U—Traction devices that do not penetrate Profile U.

SAE Class W-Traction devices that do not meet the requirements of other classes.

RATING OF WINCHES—SAE J706 NOV90

SAE Standard

Report of the Transportation and Maintenance Technical Committee, approved January 1954, revised by the Truck and Bus Powertrain Committee July 1985. Reaffirmed by the SAE Truck and Bus Powertrain Committee November 1990.

Foreword—This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

1. Scope—This SAE Standard applies only to new winches which are primarily designed for intermittent pulls and lifts and whose configuration and condition are the same as when they were shipped by the manufacturer. They are not intended to be used in any manner for the movement of personnel. They may be driven by any power source recommended by the manufacturer and will be capable of being powered in either direction. They will be equipped with an automatic safety brake system to control a load when lowering under power and positively hold a load when power is not being delivered to the winch. A hydraulic flow control valve or similar device may be used in the brake system to control a load when lowering under power. A clutch to release the drum for "free-spooling" may be provided and will be designed not to disengage itself under load. A drag brake may be provided to control "free-spooling," but will not be relied on to control or hold a load. Power sources, such as hydraulic motors, even though they may be supplied or recommended by the winch manufacturer, are not considered a part of the winch so far as this document is concerned, except to whatever extent they are a part of the brake system.

2. References

2.1 Applicable Documents—There are no referenced publications specified herein.

2.2 Definitions

2.2.1 FREE-SPOOL—The operation of unspooling wire rope from a drum by pulling on the free end of the rope while the winch is stationary. The drum is disconnected (declutched) from its powertrain during this operation.

2.2.2 WRAP—A single coil of wire rope wound on a drum.

2.2.3 LAYER—All wraps of the same diameter between drum flanges.

2.2.4 FREEBOARD—The amount of drum flange that extends radially past the top wire rope layer of a full drum.

2.2.5 FULL DRUM—A drum containing the maximum permissible number of layers as defined in 4.5.

3. General Specifications

3.1 Name Plate—A name plate containing the following information will be permanently attached to a major winch component in a location on the winch that is both conspicuous and protected.

3.1.1 Manufacturer's Name

3.1.2 Manufacturer's Model Designation

3.1.3 Rated Line Pull

"L" layer, (full drum) pounds[1]

First layer (pounds)

3.1.4 Rated Input Speed at Rated Line Pull (rpm)

3.1.5 Duty Cycle Rating (feet or °F)

3.1.6 Maximum Recommended Wire Rope Diameter (inches)

[1] Letters on this line to be approximately 50% larger than letters on the "first layer" line. Use the value of "L" calculated from 4.5 for the maximum recommended wire rope diameter.

3.2 Safety Brake System—The safety brake system will be capable of automatically and continuously holding rated load when power is not being delivered to the winch. When lowering a load under power, it will operate automatically and have adequate thermal capacity to control rated load at rated speed for a distance of 50 ft without appreciable loss of effectiveness due to temperature rise. Any loss—other than that due to normal wear—is expected to return when the brake cools. Adjusting means, automatic or manual, will be provided to compensate for wear of friction materials. When raising a load, the safety brake will automatically release and not generate an appreciable amount of heat.

3.3 Drum Release Clutch—The clutch, if provided, will be a positive-engagement type; friction-type cluctches are not acceptable. Automatically applied means such as springs, detents, or angled jaw faces will be provided to insure that the clutch will not slip out of engagement under load.

3.4 Drum Drag Brake—A drum drag brake will be provided if a drum release clutch is not provided. Its purpose is to prevent the drum from overrunning the wire rope when "free-spooling," and it will not be relied on to control or hold a load.

3.5 Drum Diameter—The drum diameter will be at least eight times the maximum recommended wire rope diameter.

4. Published Data—The manufacturer's literature will contain, as a minimum, the information in 4.1 through 4.8.

4.1 Duty Cycle Rating (feet or °F)—The duty cycle rating is the total number of feet of wire rope travel at rated line speed and one-half rated line pull to achieve a temperature rise from 100 °F to 250 °F, or, if the temperature stabilizes below 250 °F, the duty cycle is the stabilization temperature. See 5.1 for the procedure to establish the duty cycle rating.

4.2 Starting Input Torque (pound-feet)—The starting input torque is the torque at the winch input shaft required to start rated load upward from a suspended position.

4.3 Running Input Torque (pound-feet)—The running input torque is the torque at the winch input shaft required to maintain upward movement of rated load.

4.4 Rated Input Speed (rpm)—The rated input speed is the maximum permissible input speed at rated load as determined by each manufacturer.

4.5 Maximum Permissible Number of Layers—The maximum permissible number of layers of wire rope on the drum will be calculated from Equation 1. (See Figure 1.)

$$L = \frac{F - D - 2m}{2d} \quad \text{(Use integer portion or result)} \qquad \text{(Eq.1)}$$

where:

L = maximum permissible number of layers

F = drum flange diameter (inches)

D = drum Barrel diameter (inches)

d = wire rope diameter (inches)

m = freeboard ≥0.7d (inches)

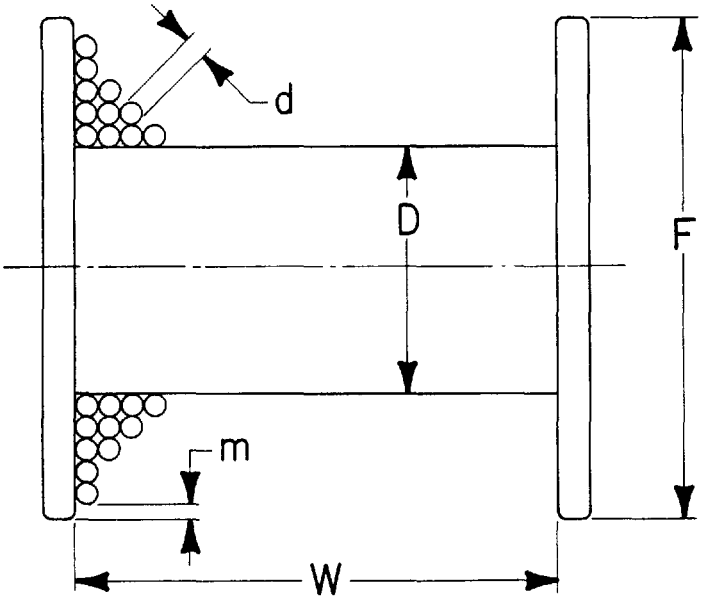

FIGURE 1—DRUM DIMENSIONS

4.6 Drum Storage Capacity (feet)—The drum storage capacity will be calculated from Equation 2 and published as a cumulative figure for each layer, using the maximum recommended wire rope size.

$$C = \frac{KW\pi n(D + nd)}{12d} \qquad \text{(Eq.2)}$$

where:

C = drum storage capacity (feet)
K = wire rope compensation factor
n = number of layers (L = maximum number)
D = drum barrel diameter (inches)
d = wire rope diameter (inches)
W = width between drum flanges (inches)

The wire rope compensation factor, K, is used to correct for spooling and dimensional variations. It has a normal range of 0.7 to 0.9. The manufacturer will include in the literature the value of K used to calculate the drum storage capacity.

4.7 Rated Line Pull (pounds)—The rated line pull is the line pull on any layer that results from the output torque that produces maximum rated line pull on the first layer. The rated line pull will be calculated from Equation 3 and published for each layer, using the maximum recommended wire rope size.

$$P = P\,max\frac{d + D}{d(2n - 1) + D} \qquad \text{(Eq.3)}$$

where:

P = rated line pull (pounds)
d = wire rope diameter (inches)
D = drum barrel diameter (inches)
n = number of layers (L = maximum number)
Pmax = maximum (first layer) rated line pull (pounds) (See 5.2 for the procedure to establish maximum rated line pull.)

The following note will be published in conjunction with rated line pulls when wire rope is not provided with the winch: "The rated line pulls shown are for the winch only. Consult the wire rope manufacturer for wire rope ratings."

When wire rope is provided with the winch, the following note will be published in conjunction with rated line pulls: "Rated line pulls shown are for the winch only. The breaking strength of new (size and construction) wire rope is (breaking strength) (pounds)." The winch manufacturer will use the description and breaking strength of the wire rope provided with the winch in the preceding paragraph.

If a layer is not specified, numerical reference to rated line pull in the manufacturer's literature will be shown as two numbers with a slash mark between them. The first number is the rated line pull for the full drum, and the second is the rated line pull for the first layer. Each such reference will include an asterisk which refers the reader to a note which reads: "The first number is the rated line pull in pounds for the full drum, and the second number is the rated line pull in pounds for the first layer."

4.8 Rated Line Speed (feet per minute)—Rated line speed is the line speed on any layer that results from rated input speed (see 4.4). The rated line speed will be calculated from Equation 4 and published for each layer, using the maximum recommended wire rope size.

$$S = \frac{N\pi d(2n - 1) + D}{12R} \qquad \text{(Eq.4)}$$

where:

S = rated line speed (feet per minute)
N = rated input speed (rpm)
d = wire rope diameter (inches)
n = number of layer (L = maximum number)
D = drum barrel diameter (inches)
R = gear ratio

5. Manufacturer's Test Procedures

5.1 Duty Cycle Rating

5.1.1 The duty cycle rating will be established by continuously raising and lowering a load equal to or greater than one-half rated load at rated line speed without stopping at the top and bottom of each lift any longer than necessary to reverse direction. The test begins when the lubricating oil temperature reaches 100 °F and terminates when the oil temperature either reaches 250 °F or stabilizes below 250 °F. The duty cycle rating is the total feet of travel, both up and down, between 100 °F and 250 °F, or, if the temperature stabilizes below 250 °F, the duty cycle rating is the stablization temperature.

5.1.2 The duty cycle may also be established by utilizing a hydraulic cylinder or other means provided the line speed, applied load, and measured or calculated travel are equivalent to those in 5.1.1.

5.1.3 The oil used in the test will be the same kind and quantity that is recommended or normally furnished with the winch.

5.1.4 Cooling means will not be used unless such means are an integral part of the winch that will be sold with the winch.

5.1.5 Ambient temperature will be between 55 °F and 85 °F, and the winch will be tested in relatively still air.

5.2 Maximum Rated Line Pull—Maximum rated line pull will be established as follows:

5.2.1 A load equal to twice the desired maximum rated line pull will be applied to the drum on the first layer at an effective distance from one flange of no more than five times the maximum recommended wire rope diameter. This load will be maintained while the winch is powered for at least one drum revolution at half of rated line speed. The direction of pull will be on a horizontal within ±15 degrees and perpendicular to the centerline of the winch drum within ±5 degrees. The test will then be repeated with a load equal to the desired rated line pull. Both tests will then be repeated on the opposite end of the drum.

5.2.2 In order to obtain sufficient wire rope strength to lift twice the desired maximum rated load, the rope may be oversized, or multiple wire ropes may be used, or both. If wire rope of a size other than the maximum recommended size is used, rated line pull must be adjusted per Equation 5.

$$P = \frac{Qt}{r} \qquad \text{(Eq.5)}$$

where:

P = rated line pull (pounds)
Q = test load (pounds)
t = radius to center of test load rope from centerline of drum (inches)
r = radius to center of first layer of maximum recommended wire rope size from centerline of drum (inches)

All the previous tests will be performed using production winches that are comparable to those that will subsequently be identified as complying with this specification, except as indicated in Section 6.

6. Test Winches

6.1 In those cases where two winch models differ from each other only in ways that do not involve load-carrying members, only one model need be tested to qualify both models.

6.2 In those cases where two or more winches utilize the same parts assembled in different ways to obtain different configurations, only one model