Sheave Selection

There is probably more material There is probably more material available on sheave selection than any other piece of cable equipment. By summarizing and analyzing all this data it will give the operator greater choice injudging the proper size sheave for an operation.

There are two important characteristics of sheaves that must be considered. These are the sheave groove and sheave diameter. Of these two, running a cable with an improper groove shape can do more damage to a cable faster than running with the wrong diameter. Correct sheave groove shape and size is more important when running multi-conductor cable, as the core is easily deformed and the thin conductor insulation can be damaged more easily.

Sheave Groove

- The groove of a new sheave should have a diameter 5% greater than the cable diameter.
- Cables should not be run over sheaves if the sheave groove diameter is 10% greater than the cable diameter.
- The sheave groove should be machined to support from 135 to 150 degrees of the cable diameter.
- Sheaves should NEVER be used on 2d ifferent diameter cables.

Sheave Diameter

There are two rules of thumb that are published in cable literature that indicate the minimum sheave diameter that should be used for operating a cable up to its rated Maximum Working Load. The first rule states that the minimum sheave diameter, SD, should be 60 times the cable diameter, D, and the second rule states that the minimum sheave diameter should be 400 times the outer armor wire diameter, d.

Camesa Cable Type	Cable Dia. D - in	Cable Dia. D - in	Outer Wire Dia. d - in	Sheave Dia. SD= 60xD - in	Sheave Dia. SD= 400xd - in
1N10	1/10	0.101	0.014	6.1	5.6
1N12	1/8	0.125	0.0175	7.5	7.0
1K18	3/16	0.185	0.0358	11.1	14.3
1K22	7/32	0.224	0.0358	13.5	14.3
1N22	7/32	0.224	0.0310	13.5	12.4
1N25	1/4	0.258	0.0358	15.5	14.3
1N29	9/32	0.288	0.0400	17.3	16.0
1N32	5/16	0.322	0.0445	19.3	17.8
1N38	3/8	0.380	0.0525	22.8	21.0
1N42	7/16	0.425	0.0585	25.5	23.4
7Q38	3/8	0.378	0.0525	22.7	21.0
7Q42	7/16	0.428	0.0585	25.7	23.4
7Q46	15/32	0.464	0.0495	27.8	19.8
7Q47	Slammer	0.474	0.0655	28.5	26.2
7Q48	Slammer	0.484	0.0670	29.0	26.8

In addition to the two rules listed above there is a formula commonly used to determine the safe minimum sheave diameter for different working loads. This can be useful in shallow operations where the maximum tensions, Tmax, are low and therefore the cable can be operated on smaller diametersheaves without damage to the cable or reduction of cable life.This formula for minimum Sheave Diameter, SD, is:

N= Number of outer armor wires,
d = diameter of outer armor wires - in
BS = Cable breaking strength - Klbs,
Tmax = Maximum operating tension – Klbs
SD = [80(Tmax / BS) + 20][d(N/2.8 + 1)]; - in (Sheave Diameter)

For example: Camesa type: 1N32 operating with the maximum tension, never over 3.0 Klb
BS = 11.2 Klb ; Tmax = 3.0 Klbs ; d = 0.0445; N = 18
SD = [80(3.0 / 11.2) + 20][0.0445(18 / 2.8 + 1)] = [41.6][0.0445(7.43)] = 13.75 in

Operating under low tensions conditions, the minimum recommended sheave diameter, using this formula, for a 1N32 cable would be 14” compared to an 18” sheave diameter for operating at maximum rated loads.When a cable, under load, is bent around a sheave the armor wires experience a bending stress in addition to the stress from the load. The smaller the sheave diameter, the higher the bending stress. It is this combined stress that is the main factor in establishing the minimum sheave diameter. When this combined stress exceeds the yield strength of the wire it will result in loose outer armor wires. When this combined stress exceeds the tensile strength of the wire, the wire and possibly the cable will break. Using the above recommended or larger sheave sizes will avoid such failures.

Sheave Alignment

It is important that proper sheave alignment is attained during well site set up. When the sheaves are not properly aligned, the cable will attempt to “crawl” up the sides of the sheave wheel grooves. This action can result not only in distorting the sheave grooves but can also introduce additional torque in the cable.

The materials used in the construction of sheaves has changed over the years. The most popular sheaves are now the “Composite Sheaves”. These composite sheaves have become standard with most major service companies. These sheaves have the wheels and guards manufactured from synthetic materials, which has resulted in a 40% reduction in the weight. When manufactured, these sheaves have the correct groove size and shape to properly support the cable. In use however the composite sheave groove can be quickly damaged from poor sheave alignment.

Cable with Splices

In running cables with complete splices it is extremely important that the sheaves have the proper groove shape to support the cable. Spliced cables should always be run using the largest sheave size available with the proper groove shape.