AR-650™ HEAVY DUTY, ABRASION RESISTANT, ANTI-FRICTION CONTROL CABLE LINER

DESCRIPTION

Markel AR-650™ Heavy Duty Abrasion Resistant Anti-friction Control Cable Liner is PTFE with a proprietary high temperature polymer filler designed to enhance cycle life under heavy loads while maintaining the basic anti-slip stick characteristic of PTFE. It is the industry premier liner in terms of efficiency, load bearing capability and life cycle expectation. AR-650™ Liner (yellow) is patented and has been designed for use with or without a silicone lubricant. It replaces the original industry standard AR-500™ Liner (brown).

APPLICATIONS

Markel Jacketed AR-650™ liner is ideally suited for heavy duty cables used in accelerator, clutch and manual or automatic transmission actuator assemblies. Difficult routings and ever increasing operating temperatures in engine compartments require the use of high performance cable liners to meet demand for longer life cycle performance. Non-automotive applications include aircraft, heavy duty off-road equipment and industrial controls.

SPECIFICATIONS

Markel AR-650™ Liner meets the performance requirements of the following industry specifications and replaces the original Markel AR-500™ Liner.

- Ford ESA-M4D465-A2
- General Motors TF004.AA
- General Motors GMW-15702-020251 PTFE
- Chrysler PF-8244, 8695, 8762, 8992, 9168 and 9530

KEY BENEFITS

- Markel AR-650™ Anti-Friction Liner Eliminates “stick-slip”
- 90% average efficiency through 1,000,000 cycles with 25 lb. load
- High Temperature Operation
- Plastic Jacketed Liner offers significant weight reduction compared to steel flat wrap.
- Jacket can be stabilized to liner with Markel Teflock™ Splined Liner
- Specified by major manufacturers of automotive control cables in North America and Europe.

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AR-650™ / AR-500™ LINER COMPARISON

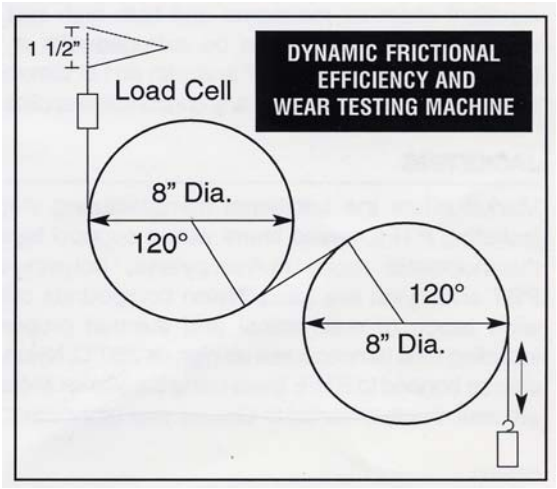
CHARACTERISTICS

PROPERTY	TEST METHOD	AR-650™	AR-500™
Continuous Use Temperature ,°C		200	200
Tensile Strength , MPa (psi)	ASTM D 638	38.8 (5623)	38.3 (5547)
Elongation , %	ASTM D 638	313	293
Specific Gravity, Method A-1	ASTM D 792	2.11	2.06
Durometer “D”, 15 seconds	ASTM D 676	55	55
Color	N/A	Yellow	Brown
Base Material	N/A	PTFE	PTFE
Filler	N/A	Proprietary High Temperature Polymer	Polyphenylene Sulfide
Particle Size of Filler	N/A	90% @ <20 micron*	90% @ <30 micron
Dimensional Capability (ID and OD)	AIAG MSA	Cp 2.722 Cpk 2.482	Cp 2.705 Cpk 2.036
Melt Point (°C)	DSC 20° / min.	PTFE @ 327, Filler degrades @ >450	PTFE @ 327, Filler @ 277
Chemical Resistance	Imersion, 1 Week @ 25°C	No Swelling or Loss of Mechanical Properties, see list below	No Swelling or Loss of Mechanical Properties, see list below

Chemicals Tested: Hydraulic Fluid, Hydrocarbon Solvents, Brake Fluid, Lubricants, Alkaline and Acidic Aqueous Solutions
*Smaller particle size enhances dispersion in the compound for greater homogeneity leading to less process variation.

TYPICAL LIFE CYCLE PERFORMANCE

TEST	AR-650™	AR-500™
Test Cycles	1,000,000	1,000,000
Load. Lbs.	6-18 lbs 26.7-80N	6-18 Lbs. 26.7-80N
Initial Efficiency	88%	86%
Final Efficiency	92%	91%
Loss Factor K, $In.^3$-min/ lbs-ft.-hr. (tested dry)	7.5	25



NOTES: Tested with E-155 Silicone lubricant (Wacker Silicone, Adrian, MI). Machine performs a reciprocating motion. A spring applies 18 Lbs./80N at full extension and 6 Lbs./26.7N in the compression portion of the test cycle.
A 25 Lb.//111N weight, shown in the illustration, is.used for the heavy duty test. Typical performance data are not intended for use as design data.

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