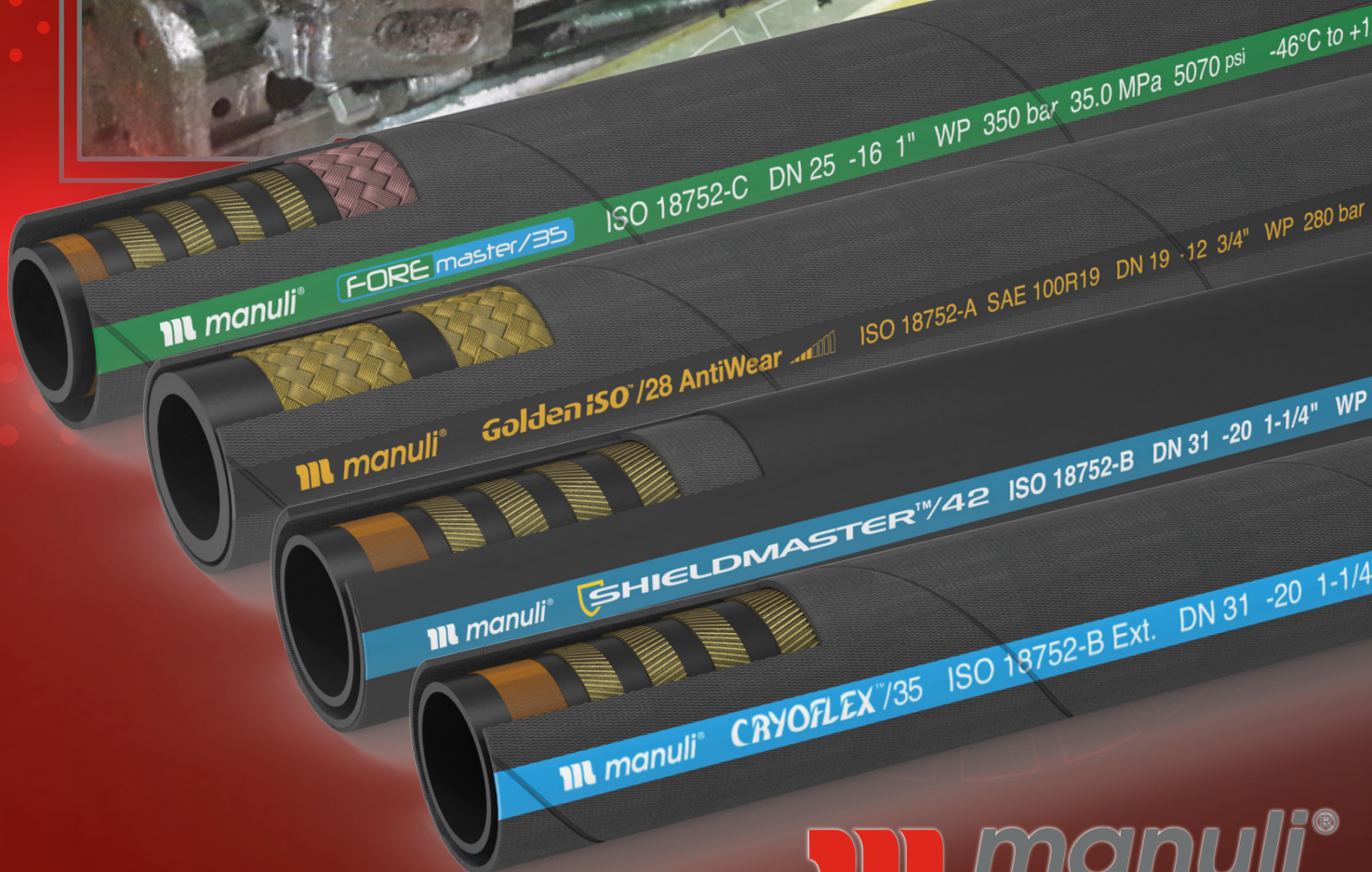


ABRASION RESISTANT HOSE COVERS



SELECTING THE RIGHT HOSE

Choosing the correct hydraulic hose for the job requires careful consideration. The widespread use of hydraulics in a variety of industries and environments means that characteristics such as robustness, flexibility, chemical resistance and operating temperature must all be considered.

However, most experts agree that the hose cover is the singular most important part of a hose's construction, as wear of the cover due to environmental factors is the primary cause of hose failure. It is therefore critical that the hose cover be as robust and long-lasting as it can be, whilst also meeting the other specific requirements of the system it is included in.

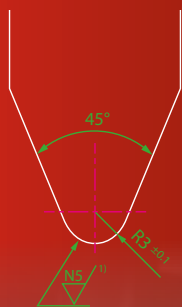
Manuli Hydraulics has developed a range of highly innovative and proprietary cover materials and structures to ensure maximum service life in even the most harsh of environmental conditions. The outstanding performance of our cover materials compared to many of our competitors' products illustrates the fact that, whilst hose selection itself may be complex, making sure you choose the right cover need not be.



HOW DOES ABRASION TESTING WORK?

The industry standard abrasion test for hydraulic hoses is defined by BS EN ISO 6945*, and uses a weighted reciprocating die of standardised design to perform repeated scuffing of the hose cover. The hose is weighed before and after the test to determine the weight of rubber lost after 2,000 cycles. European standards EN 853, EN 856 and EN 857 define the maximum allowable weight of rubber lost during this test to be:**

- **Thin cover / Wire braided hose - 0.50g lost with a 2.5kg load applied**
- **Thick cover / Wire spiral hose - 1.00g lost with a 5kg load applied**



Abrading Tool specification

Hoses which comply with these standards must be proven to have lost less than the stated amount, with the best performers achieving the lowest weight loss between weighings.

**At the time of writing BS EN ISO 6945 was no longer extant, having been replaced by Annex A of EN 853, EN 856 & EN 857. However, the test method defined in these newer norms is the same as that defined in the earlier norm. Data presented in this document still references BS EN ISO 6945 as that was the standard to which the tests were originally performed.*

***SAE J517 does not specify an abrasion resistance requirement*

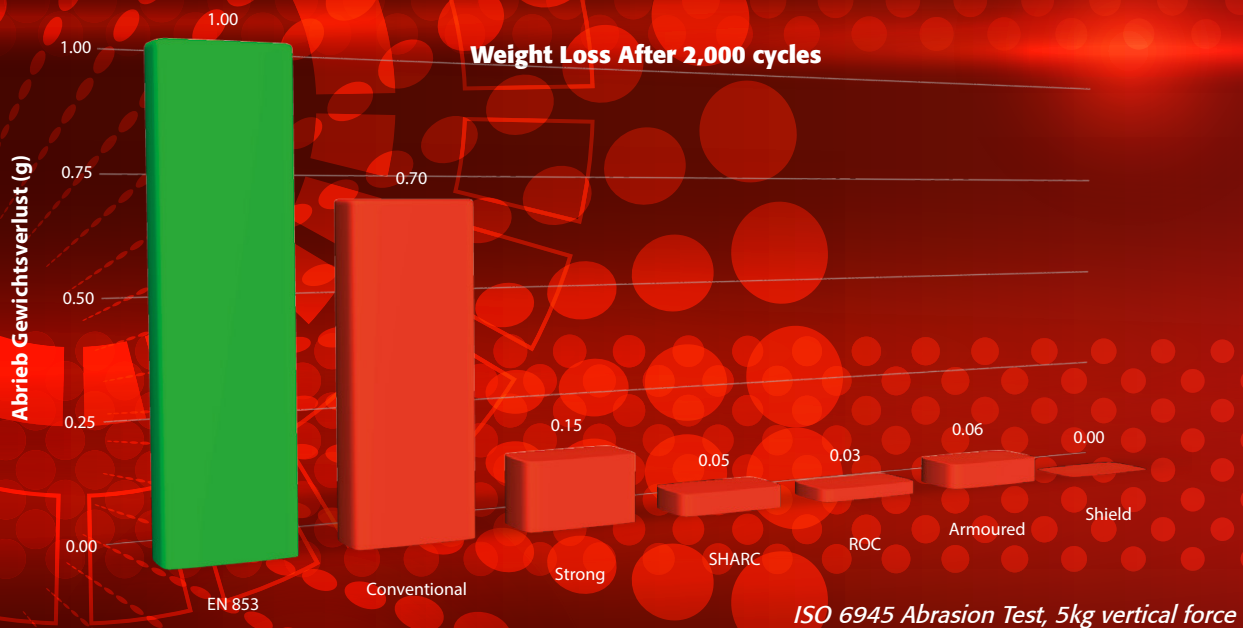


MANULI HAS YOU COVERED

Progressively developed over several years and multiple hose families, the Manuli Hydraulics range of hose cover solutions is many and varied. Aside from certain application-specific covers dedicated to unique hose families, Manuli offers 6 fundamental hose cover types:

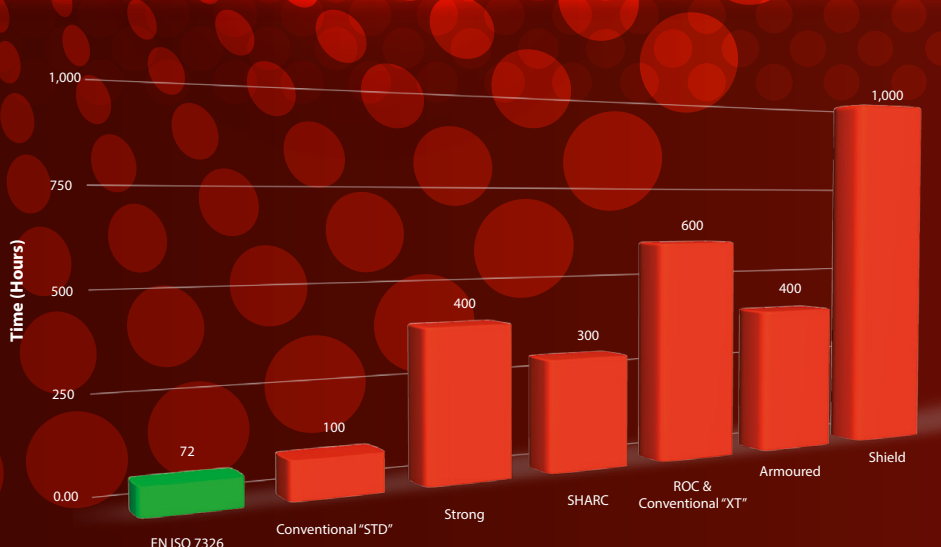
- **Conventional Cover** - "STD" & "XT" Type
- **Strong Cover** - "SD" & "SC" Type
- **Super High Abrasion Resistant Cover (SHARC)**
- **Rubber Outstanding Cover (ROC.)**
- **Armoured Cover**
- **Shield Cover**

The relative abrasion resistance performance of each of these cover types compared to EN 853 can be assessed from the below graph:



OZONE RESISTANCE

In addition to their outstanding performance against abrasion, the above range of Manuli covers also boast a high level of resistance to cracking due to ozone exposure. The general rule of thumb is that abrasion resistance and ozone resistance for a cover compound are inversely proportional. So high abrasion resistance leads to poor ozone resistance, and vice versa.



EN ISO 7326 Ozone Resistance Test

However, in contrast to these typical material limitations, each of the above Manuli cover compounds performs noticeably better than the required test specification, EN ISO 7326.

WHERE ARE THE COVERS USED?

DN	5	6	8	10	12	16	19	25	31	38	51	60	63	76	89	102
ASTRO/2		STD	STD	STD	STD	STD	STD	STD	STD	STD						
ASTRO/3		STD	STD	STD	STD	STD	STD	STD	STD	STD	STD					
HARVESTER/17		STD	STD	STD	STD											
JACKMASTER/70		STD		STD												
LUBEMASTER		STD		STD												
LYTE-FLEX		STD	STD	STD	STD	STD	STD	STD								
MULTITEX	STD	STD	STD	STD	STD	STD	STD	STD								
PUSHFIT		STD	STD	STD	STD	STD	STD	STD								
SPIRTEX							STD	STD	STD	STD	STD		STD	STD	STD	STD
TRACTOR/1SN		STD	STD	STD	STD											
TRACTOR/2SN		STD	STD	STD	STD											
TWINPOWER 4000				STD	STD											
EQUATOR/1 (BLACK)		XT	XT	XT	XT	XT	XT	XT	XT	XT	XT		XT			
EQUATOR/1 (BLUE)		XT	XT	XT	XT	XT	XT	XT	XT	XT	XT		XT			
EQUATOR/2 (BLACK)		XT	XT	XT	XT	XT	XT	XT	XT	XT	XT					
EQUATOR/2 (BLUE)		XT	XT	XT	XT	XT	XT	XT	XT	XT	XT					
DIAMONDSPIR							SD	SD	SD	SD	SD					
ETERNITY/2		SD	SD	SD	SD	SD	SD	SD								
ROCKMASTER/12				SD	SD	SD	SD	SD	SD	SD	SD					
ROCKMASTER/13		SD		SD	SD		SD	SD	SD	SD	SD					
ROCKMASTER/15							SD	SD	SD	SD	SD					
ROCKMASTER/1SC		SD	SD	SD	SD	SD	SD	SD	SD	SD	SD					
ROCKMASTER/1SN		SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD				
ROCKMASTER/2 PLUS		SD		SD	SD	SD	SD	SD	SD	SD	SD			SD		
ROCKMASTER/2SC	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD		SD	SD		
ROCKMASTER/2SN		SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD				
ROCKMASTER/2ST	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD					
ROCKMASTER/4SH						SD	SD	SD	SD	SD	SD					
ROCKMASTER/4SP		SD		SD	SD	SD	SD	SD	SD	SD	SD					
TWINPOWER 5000			SD	SD	SD											
TWINPOWER/PLUS					SD											
ANACONDA							SC	SC	SC	SC						
CRYOFLEX/21						SC	SC									
CRYOFLEX/35		SC		SC	SC		SC	SC	SC							
CRYOFLEX/42							SC	SC		SC	SC					
DIAMONDSPIR/14														SC		
DIAMONDSPIR/21													SC	SC		
DIAMONDSPIR/35													SC	SC		
DIAMONDSPIR/62									SC							
GOLDENISO/35 LONGLIFE		SC		SC												
GOLDENISO/38 LONGLIFE							SC	SC	SC	SC	SC					
GOLDENISO/45 LONGLIFE		SC			SD	SD	SD	SD								
GOLDENISO/14 PILOT		SC	SC	SC	SC											
GOLDENISO/21 XTRAFLEX									SC	SC	SC					
GOLDENISO/28 XTRAFLEX				SC	SC	SC	SC	SC	SC	SC	SC					
GOLDENISO/35 XTRAFLEX				SC	SC	SC	SC	SC	SC	SC	SC					
GOLDENISO/42 XTRAFLEX				SC	SC	SC	SC	SC	SC	SC						
GOLDENMINE													SC			
HERCULES/HT									SC	SC	SC					
HYDROROPE									SC	SC	SC					
GOLDENISO/21 ANTIWEAR																
GOLDENISO/28 ANTIWEAR																
XTRAFLOW/2WB																
XTRAFLOW/4WS																
XTRAFLOW/HT													XT	XT	XT	
FOREMASTER/21																
FOREMASTER/28																
ROCKMASTER/2 PLUS SUPER-AW																
FOREMASTER/35																
FOREMASTER/42																
SHIELDMASTER/21																
SHIELDMASTER/28																
SHIELDMASTER/35																
SHIELDMASTER/42																

CONVENTIONAL

STD / XT

STRONG

SD / SC

SHARC

ROC

ARMOURED

SHIELD



Conventional Cover are prime examples of the perfect balance between reliability, toughness and value.

"XT" Type - The Conventional Cover is also used as the basis for the "XT" type covers used on premium hose ranges such as **Equator**. In these cases, the abrasion resistance characteristic remain consistent with the Conventional Cover, but the covers have significantly upgraded ozone resistance and an extended operational temperature range of -55°C to + 135°C.

CONVENTIONAL COVER

As Manuli's base-line cover compound, the Conventional Cover is fully compliant to current international specifications for both abrasion and ozone resistance.

Used primarily on the classic Manuli hose ranges, such as **Tractor**, this cover is robust enough for most general hydraulic applications where excessive abrasion or ozone exposure is not expected.

With a working temperature range of -40°C to +100°C, hoses with the



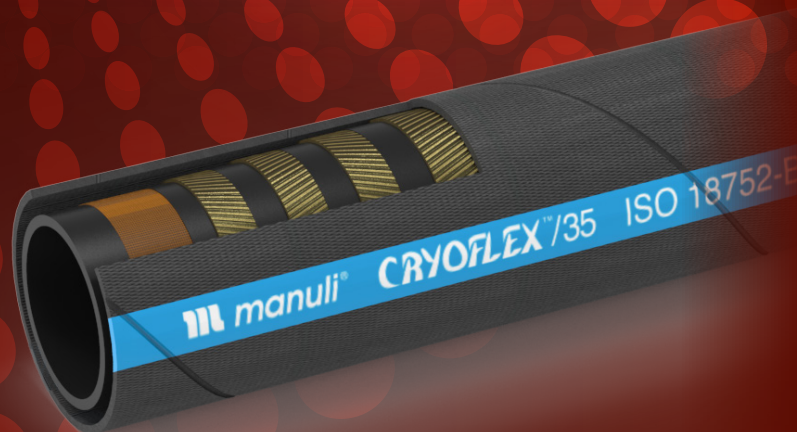
STRONG COVER

As the first major performance step change in both abrasion and ozone resistance, the Strong Cover outperforms the Conventional Cover four times over in these areas. It is for this reason that two of Manuli's core product families, **RockMaster** and **GoldenIso** (except AntiWear) use this cover type.

The Strong Cover comes in two types:

"SD" Type - Used on the majority of **RockMaster** products, as well as **Pilot** and **Eternity/2**, the "SD" cover has a minimum working temperature of -40°C.

"SC" Type - Used on the new **Cryoflex** range, the "SC" cover compound has an extreme resistance to low temperatures, allowing it to remain flexible down to -60°C.

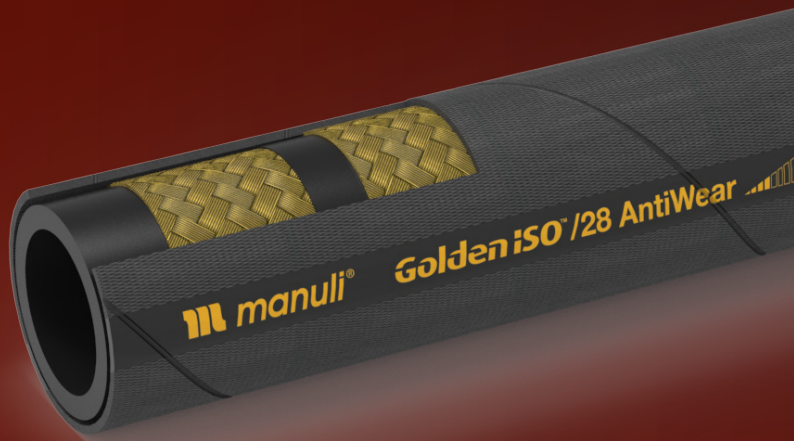


SUPER HIGH ABRASION RESISTANT COVER – SHARC

Developed as a high-protection cover, the SHARC solution provides abrasion and weathering resistance to a standard which makes it ideal for all but the most extreme of applications.

Used on the **GoldenIso AntiWear** and **Xtraflow** hydraulic hose ranges, the SHARC solution ensures long lasting, reliable hose protection in some of the toughest operational environments.

The SHARC solution also has high fire resistance and anti-static properties, making it suitable for use in highly regulated applications such as mining and offshore drilling.

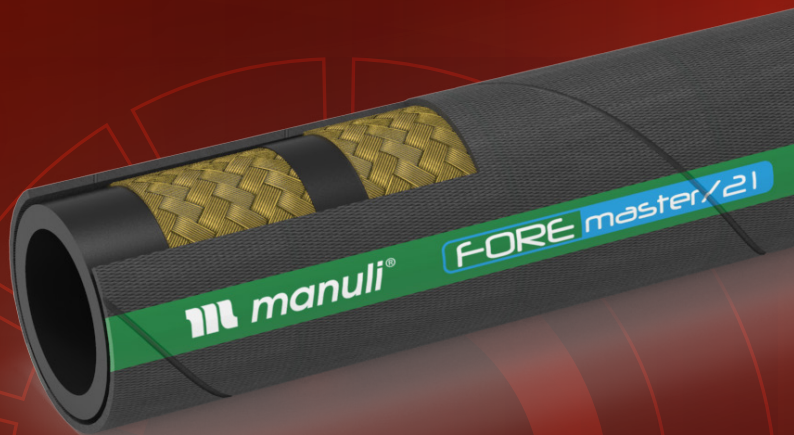


RUBBER OUTSTANDING COVER – ROC

Specifically designed for extreme abrasion and weathering resistance on heavy duty hoses, the ROC solution easily out-performs all but the toughest and most resilient hose cover solutions.

Used on the newly released **RockMaster/2 Plus Super-AntiWear** hose family and within the new **ForeMaster** range, the ROC solution has already proven itself to be a superb investment for use in the harshest of environmental conditions.

Once again, a high fire and anti-static resistance, coupled with an ability to function at very low temperatures, makes the ROC solution a highly versatile addition to the Manuli Hydraulics cover solutions range.





ARMoured COVER

The Armoured Cover is the culmination of years of research and development in both hose structural design and rubber compound formulation. This innovative new cover is made up of two fundamental elements:

- Outer cover made from a proprietary, specially formulated anti-wear rubber compound
- High-tensile textile breaker layer

The Armoured Cover is currently used on the higher pressure hose lines within the **ForeMaster** range of hoses.

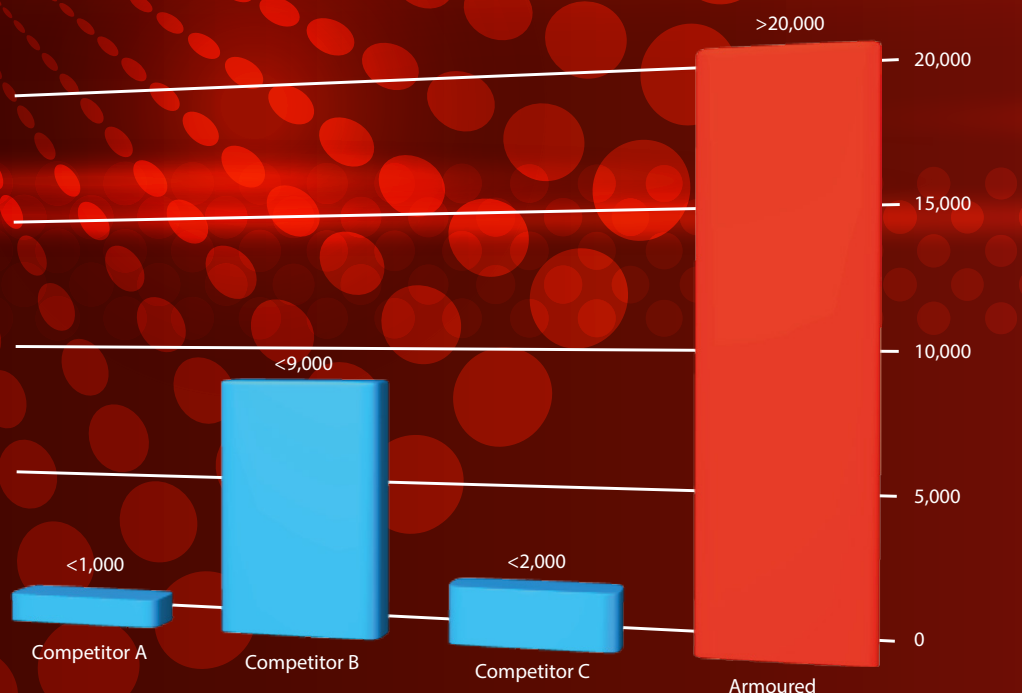
PUTTING IT TO THE TEST

In standard ISO 6945 abrasion tests a reciprocating 5kg load is used to create wear on the hose cover. The test lasts for 2,000 cycles and measures the mass of material lost. The lower the result, the better the performance.

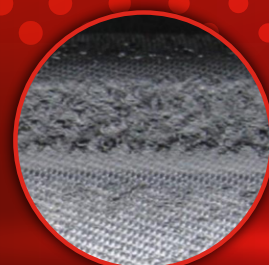
However, to truly test the performance of the Armoured Cover, Manuli devised a more severe test. A 10kg reciprocating load was used, and the number of cycles required to expose the steel reinforcement was determined. In this case, the higher the result, the better the performance.

Whilst hoses with the Armoured Cover performed up to 4 times better than the competition in standard ISO 6945 abrasion tests, they lasted as much as 30 times longer before the steel reinforcement was exposed.

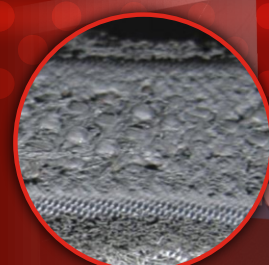
Number of Cycles Before Reinforcement Exposure



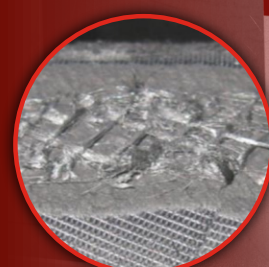
Modified ISO 6945 Abrasion Test, 10kg vertical force



2,000 cycles (10kg)



20,000 cycles (10kg)



60,000 cycles (10kg)

SHIELD COVER

The Shield Cover solution is designed for maximum hose to hose abrasion and weathering resistance in none friction-flexing and non-impact applications.

Used throughout the **ShieldMaster** hose family and comprising a robust synthetic rubber layer with an additional ultra-high molecular weight polyethylene (UHMWPE) outer skin, the Shield Cover outperforms all other Manuli cover types in its resistance to both abrasion and ozone.

In fact the abrasion resistance of the Shield Cover is so great that under standard ISO 6945 test conditions it is necessary to perform around 1 million cycles to register a discernible weight loss.

The self-lubricating properties of UHMWPE make the Shield Cover perfect for situations where bunches of hoses rub against each other, and the smooth cover finish provides an easy-to-clean alternative to spring guards.

In addition to its outstanding abrasion and weathering resistance, the Shield Cover also resists cracking down to -46°C and has flame retardant and anti-static properties, making it suitable for use in even the harshest environments.





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