



Eaton's new development on braided hoses extends service-life to one-million cycles and increases flexibility and pressure resistance

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Executive summary

Eaton has developed Aeroquip® Dynamax EC881, a new high performing two wire braided hose, with several technical developments qualified to one million impulse cycles utilizing new generation inner tube, better wire architecture, superior flexibility and high abrasion resistance - Dura-Tuff™ cover. The new hose features superior flexibility and abrasion resistance at the same time.

A hydraulic hose is a composite structure primarily consisting of alternate layers of rubber and steel. Each hose consists primarily of three layers - Tube, Reinforcement and Cover. Hydraulic hoses are used in a variety of industries such as Oil & Gas drilling, Agriculture, Construction, Mining equipment, Heavy machinery and Household appliances, amongst others.

In most of these industries, hoses are used in machinery and equipment where a continuous uptime is extremely critical, since a downtime can result in huge costs being incurred. A typical hydraulic hose assembly in mining lasts anywhere between 3000 to 6000 hours, which in working conditions means one to two years, after which the inner tube becomes brittle and loses its rubber form. Often, the hose wears out even before the assigned lifetime of two years, increasing the downtime on an open pit excavator. A broken down open pit excavator can result in the whole mine being stagnant.

Hydraulic hoses can fail due to a number of factors such as pulling, abrasion and twisting of the wire layers due to multi-plane bending, unfavorable operating conditions, improper assembling and other negative impacts. The operating conditions of the hose determine its service life. For instance, extreme temperatures can accelerate aging whilst frequent and extreme pressure fluctuations can accelerate fatigue life. Tighter bends also reduce the life dramatically. So, hydraulic hoses have a finite service life that can be reduced by many variable factors such as pressure cycles and pulsations, temperature extremes and the hose's minimum bend radius. Failures in field are of two types (1) Inside out and (2) Outside in failure. Study shows that 31% of the failure is of the first type, as a result of tube aging.

SAE Standard J517 establishes minimum hydraulic hose specifications for these three factors.



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The most appropriate correlation of inside out failure of hoses in application are:

1. Impulse cycles at extreme condition
2. Material aging

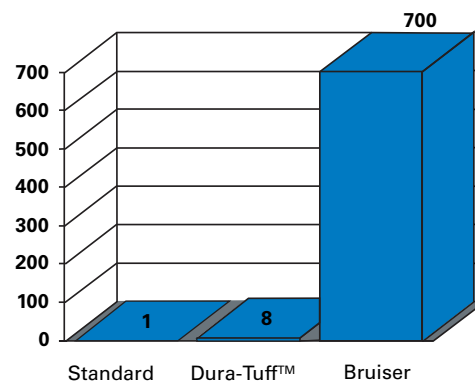
EC881 delivers a 35% percent higher pressure capability when compared to EN857 2SC standard hoses. The new EC881 two wire braided hose can be an alternative hose, where expensive four spiral hoses have had been used to cope with system pressures.

- Impulse cycles are key measures in the life expectancy and overall quality of a hydraulic hose. Compared to standard EN857 2SC hoses, which are qualified to 200,000 cycles, EC881 exceeds the standard by 5x and provides exceptional performance in tough applications. Eaton's new generation hydraulic hose tube has 5x longer life than typical 2SC hose in the industry with a traditional NBR (acrylonitrile butadiene rubber) inner tube. EC881 tube has slow aging and a low compression set, which provides better sealing and leak free performance.
- EC881 provides superior flexibility (1/3 SAE 100R2 bend radius at 100°C) that helps easier installation in tighter spaces, decreasing failures caused by a tighter bend and reduces hose length requirements.
- All rubber compounds deform when a force is applied to them for a long period of time. When the force is removed there is a remaining permanent deformation, called compression set. In every application where rubber is used to create a seal, such as in hydraulic hoses (seals between the insert /nipple of the fitting and the tube) cause permanent deformation, which is a concern as it is possible to obtain leaks over time. Therefore to have a longer life in an application, it is critical that a tube in the hydraulic hose used has a low compression set. Eaton's new generation of hydraulic hose tube used in the Dynamax EC881 needs 5X longer time to reach similar compression compared to standard tubes. This means better sealing for longer time and leak free performance.

The most appropriate correlation of outside in failure of hoses in application are:

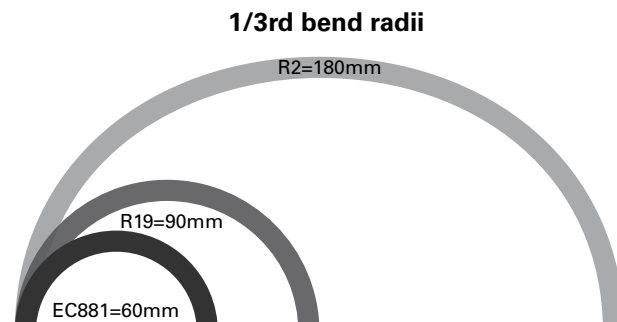
- The main reason for "outside in failure" is directly related to abrasion or external damage to the hose cover. Many of these failures can be prevented using a proper hose with an abrasion resistant cover. Eaton Dynamax EC881 comes with a Dura-Tuff™ cover that provides 8x better abrasion resistance compared to a standard synthetic rubber cover. For applications that require very high abrasion resistance the EC881B is an ideal choice, this hose provides 700x better abrasion protection than a standard 2SC hose. Additionally, for applications with high abrasion resistance the EC881B contains a Brusier cover, providing 700x better abrasion resistance than a standard 2SC hose.

Abrasion resistance – Standard vs Dura-Tuff™ vs Brusier™

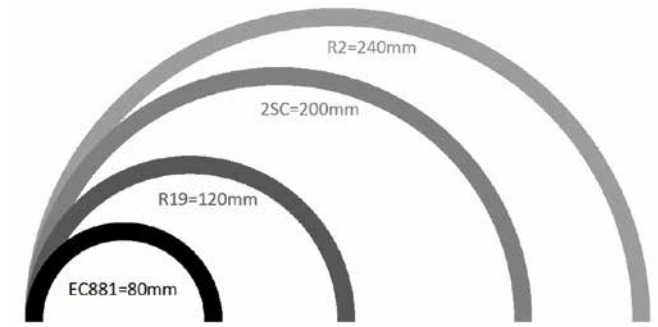
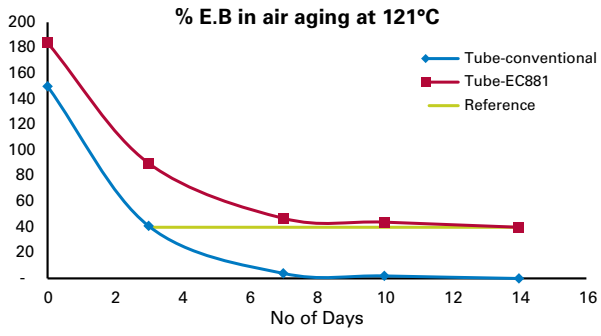


How important is the flexibility of a wire braided hydraulic hose?

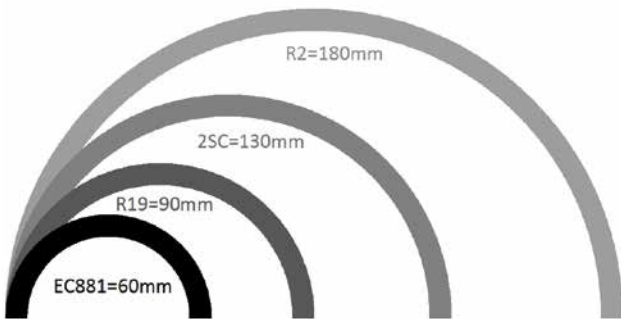
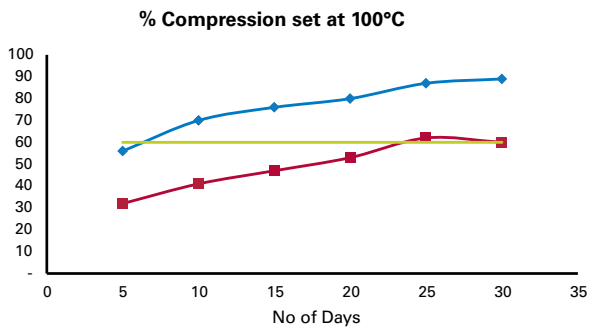
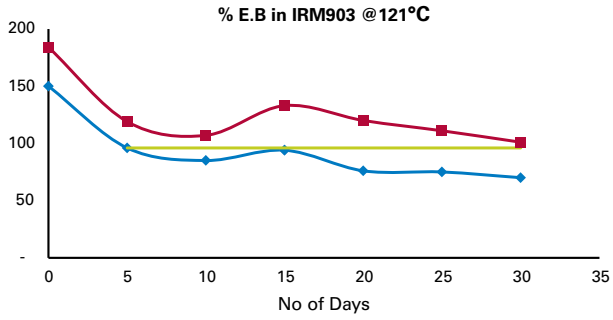
The minimum bend radius is an important factor when it comes to allocating a hydraulic hose to a mobile machine. What is minimum bend radius? This is the smallest radius that a hose can be bent through, without being damaged or kinked. The lower the bend radius the easier it is for the hose to be routed through tight spaces or around corners. This is a tremendous benefit for the designers of mobile machines, allowing them to position components in the most efficient and convenient way. Nowadays all hydraulic hose manufacturers built 2 wirebraided hoses that have a bending radius of 1/2 SAE 100R2 , but Eaton goes beyond this limit with the new Dynamax EC881, offering a bending radius of 1/3 SAE 100R2 . Providing over a 50% improvement compared to DIN/EN bending radius. A bend radius up to 1/3 the SAE specification enables use of shorter hose lengths, adding up to more value for money.



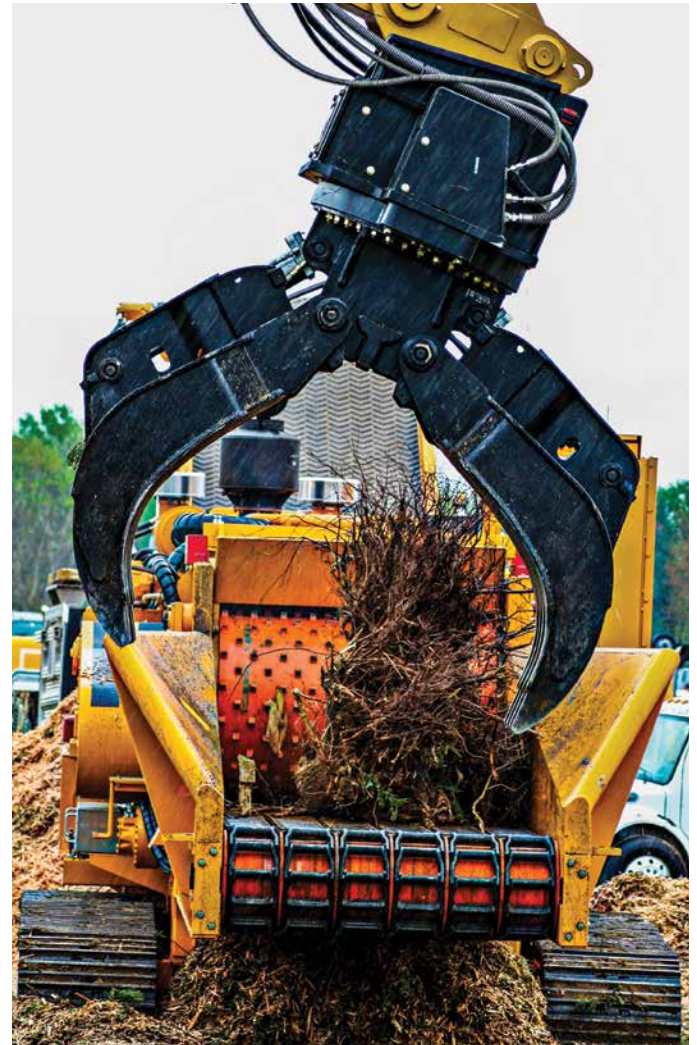
EC881 tube vs conventional tube performance



Example of -12 bend radii



Example of -8 bend radii



Eaton DYNAMAX EC881

Exceeds EN857 2SC

1 Million impulse cycle performance and 1/3 SAE bend radius



#													
Part number	Hose I.D.		Hose O.D. max		Max operating pressure		Burst pressure		Minimum bend radius		Weight		
	DN	mm	in	mm	in	bar	psi	bar	psi	mm	in	kg/m	lbs/ft
EC881-4	6	6.4	0.25	14.2	0.56	450	6525	1800	26100	33	1.30	0.32	0.21
EC881-5	8	7.9	0.31	16.0	0.63	400	5800	1600	23200	38	1.50	0.38	0.26
EC881-6	10	9.5	0.38	18.3	0.72	400	5800	1600	23200	42	1.65	0.42	0.28
EC881-8	12	12.7	0.50	21.5	0.85	360	5220	1440	20880	60	2.36	0.58	0.39
EC881-10	16	15.9	0.63	24.7	0.97	350	5075	1400	20300	68	2.68	0.75	0.50
EC881-12	19	19.0	0.75	28.6	1.13	330	4785	1320	19140	80	3.15	1.03	0.69
EC881-16	25	25.4	1.00	36.6	1.44	280	4060	1120	16240	150	5.90	1.47	0.98
EC881-20	31	31.8	1.25	44.3	1.74	172	2500	688	9980	210	8.27	1.75	1.18
EC881-24*	38	38.1	1.50	52.8	2.08	138	2000	552	7700	250	9.84	1.91	1.28
EC881-32	51	50.8	2.00	65.5	2.58	110	1600	440	6375	315	12.40	2.62	1.76

* Qualified for 800.000 cycles

Construction

- Synthetic rubber tube
- Two wire braid reinforcement
- Dura-Tuff™ synthetic rubber cover

Temperature range

- -46°C to +126°C*
 - (-50°F to +259°F)
- *at 1/2 SAE 100R2 bend radius

Application

- Hydraulic system service with petroleum and water-based fluids, for general industrial service

Agency listings

- MSHA
- DNV-GL
- ABS
- BV
- LR

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