Hose Expected Life Predictor (HELP)

The functions of hose in the paint operations is critical. Paint Hoses, whether in automatic or manual stations, provide at least six identifiable functions for that paint station. They are:

1. Contain pressure safely to prevent loss of paint or harm to booth personnel.
2. Maintain critical velocity range to preserve temperature and viscosity.
3. Provide machine or hand spray applicator range of motion needed to complete the station assignment.
4. The fourth function is to contain electrostatic voltage on systems or guns using electrostatic application, an attribute called "dielectric strength".
5. The fifth function is the speed of flushing and cleaning the paint lines, typically from a color changer in an automatic system to the applicator.
6. The last function is to provide low moisture absorption or low permeability, which is important on catalyzed coating to prevent crystallization due to moisture absorption through the paint hoses.

The materials of construction of paint hoses provide a wide range of performance attributes to address these six factors.

Please remember the difference between hose and tubing. Hose is described, specified and manufactured to meet the requirements of internal diameter (ID) characteristics. These characteristics include ID tolerances and surface finish levels. Hose is usually used with "Barb and Nut" style connectors.

Tubing is described, specified and manufactured to meet the requirements of outside diameter (OD) characteristic. These characteristics include OD tolerances and surface finish levels. Tubing is usually used with "Push-Lock" or "Compression style" fittings.

The workhorse of the industry is NYLON PAINT HOSE or tubing (NP or NHA Series), supplying as much as 85% of demand for Airspray, HVLP, Bells, and Discs; in either manual or automatic/robotic systems. Next is the COAXIAL PAINT HOSE (CPH Series), which is twice as flexible as nylon and about 20% lighter in weight. Its primary application is at handgun stations where ergonomic factors are critical. The last commonly used hose is TEFLON PAINT HOSE (FEP or PTFE Series), and it is used to address dielectric strength, provides rapid flushing and cleaning, and low moisture permeability.

The table below provides a performance ranking of each of these six factors evaluated against the three types of hose material of construction. A ranking of 1 is excellent, 2 is very good, 3 is good/average, 4 is poor and 5 is not recommended.

PERFORMANCE FACTOR	HOSE/TUBE MATERIAL OF CONSTRUCTION		
	NYLON	COAXIAL	FEP/PTFE
Pressure strength	1	3	3
Size availability	1	3	2
Motion/ Flexibility	2-3	1	3-4
Dielectric strength	5	5	1-2
Speed of cleaning	3	3	1
Moisture resistance	3	3-5	1-2

HELP from HOSCO

With regard to cost, NYLON is the most economical paint hose material, with a cost range form $0.25 to $1.00 per foot depending on the common sizes used. COAXIAL Paint Hose is available in more limited sizes or 1/4" and 3/8" ID and has a cost range of $0.85 to $1.45 per foot respectively. And TEFLON tubing (FEP/PTFE) is available in most common sizes and usually cost 5-7 times more than the common nylon of the same size. Each material has its optimum application area, which are worth restating here:

NYLON is the workhorse, providing the most robust hose or tube design, but is limited to grounded systems due to no dielectric strength.

COAXIAL hose is the choice for manual stations or where hose flexibility needs to be optimized, but is limited to the two most common hose sizes, 1/4" and 3/8" ID.

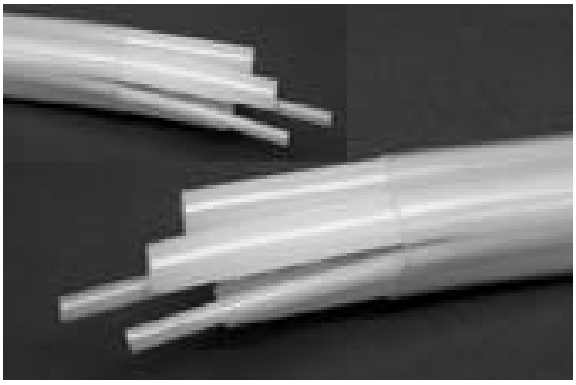
TEFLON (FEP/PTFE) should be used where voltage is present, moisture sensitive coatings are used, or color change times and/or flushing solvent usage needs to be minimized.

The intent of the rest of this brochure is to provide a worksheet for all users to uniformly evaluate the conditions that their paint hoses operate in, and to predict the MEAN TIME BETWEEN FAILURE (MTBF) of the paint hoses to minimize loss of product and production time, and eliminate exposure of personnel to accidental breaks of lines.

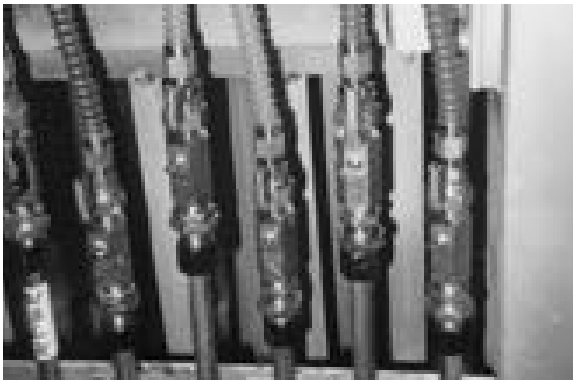
The parameters Hosco has identified that hose life is dependent on are:

1. System operating pressure — the higher the pressure the hose is exposed to, the shorter expected life the hose has. No matter what else the hose is exposed to, this is a full time exposure factor.
2. System operating temperature — the higher the temperature the hose is exposed to, the working pressure is decreased and the expected life is shorter. The general rule of thumb is that hose working pressure ratings are listed at 75°F, and with these materials of construction, increasing the temperature cuts the pressure at the same proportion of the temperature increase. (An example is increasing temperature from 75 to 95°F reduces working pressure by (95-75/75) or 26%. Again, no matter what else the hose is exposed to, this is a full time exposure factor.
3. System hose flexing ratings — tight radius bending and constant motion creates a more accelerated wear pattern on the hose.
4. System hose tension/pull rating — hoses under tension, whether occasional or almost constant shortens the hose life.
5. Environmental factor/application — some assignments are tougher on equipment such as hoses than others. This parameter addresses the severity of the spray station assignment.
6. Environmental factor/booth area — many factors are involved here from foot traffic over hoses, floor structure, to booth seam designs and metal edge exposure of the hoses.

Hosco has tried to describe the ranking scale in the most concrete and objective manner possible, however there is still some subjectivity in the assessment. We recommend using this scale framework uniformly and consistently from station to station and plant to plant, and always defer to the lowest number you feel you are in the range of to prevent hose failures.



HOSCO custom bundled paint hose for automatic systems.



Typical Hosco paint circulating station for multiple colors.

Hose Expected Life Predictor

HELP Worksheet

Station Location/Description_____

The first two parameters are evaluated on a 1-10 scale, 1 being most hostile or extreme and 10 being most friendly or longest life expectancy. The descriptive scales are:

TEMPERATURE EXPOSURE	RATING
111-115°F	1
106-110°F	2
101-105°F	3
96-100°F	4
91-95°F	5
86-90°F	6
81-85°F	7
76-80°F	8
71-75°F	9
70°F and below	10

PRESSURE EXPOSURE	RATING
Above 200 PSI	1
190-199 PSI	2
180-189 PSI	3
170-179 PSI	4
160-169 PSI	5
150-159 PSI	6
140-149 PSI	7
130-139 PSI	8
120-129 PSI	9
119 PSIand below	10

The last 4 factors are on a 1-5 scale because the factors are not as powerful in influencing the hose life as pressure and temperature. A ranking of 1 being most hostile or extreme and 5 being most friendly or longest life expectancy. The descriptive scales are:

FLEXIBILITY	RATING
Bend radius less than 5"	1
Bend radius 5-8"	2
Bend radius 8-11"	3
Bend radius 11-14"	4
Bend radius above 14"	5

TENSION/PULL	RATING
Full "cycle" tension 80-100% of cycle	1
Above avg. tension 60-80% of cycle	2
Average tension 40-60% of cycle	3
Below avg. tension 20-40% of cycle	4
Negligible tension Less than 20% of cycle	5

APPLICATION ENVIRONMENT	RATING
Firewall/Motor compartment or Decklid/Truck area	1
Interior painting (van/truck bodies)	2
Door cut in/Fascia painting	3
Wheel house opening Mirror housings	4
Dust coat of exteriors	5

SPRAYBOOTH AREA	RATING
Cat-track w/o rollers or exposed metal seams	1
Cat-track w/rollers Booth grates, high foot traffic	2
Moderate foot traffic Rolled metal seams on booth	3
Light foot traffic, Smooth booth wall	4
No traffic on hoses Smooth booth walls and floor	5

Please circle the situation that most closely describes the condition that the hoses are exposed to, add up all the Rating Numbers you selected and apply the correct safety factor from the list below. The end result number is the expected life in months of the hoses at that station.

Safety Factor Multiplier

1 shift (2080 hours production/year), multiply by 1.0
2 shifts(4160 hours production/year), multiply by 0.85
3 shifts (6240 hours production/year), multiply by 0.65

Expected Life in Months_____

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