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HARVEL®

PLASTICS, INC.

The **QUALITY** *Line*

CPVC DUCT

Chemical resistant, lightweight solutions for hot corrosive fume and drain handling systems.

Harvel CPVC Duct, available in 6" through 24" diameters, provides long lasting, cost-effective solutions for hot corrosive fume and drain handling systems.

Harvel Corzan® CPVC Duct has exceptional fire resistance, excellent resistance to corrosion, high heat distortion temperature and good mechanical strength. This unique balance of physical properties, combined with the product's inherent light weight and ease of fabrication is now available in large diameters. Harvel CPVC Duct provides a long-lasting, cost-effective solution to many industrial applications involving hot corrosive fume and drain service.

PHYSICAL PROPERTIES

Harvel CPVC Duct systems perform well in many aggressive environments that are not suitable for other types of duct piping material. Due to the unique properties of the Corzan® material, Harvel CPVC Duct maintains high tensile strength and modulus over a wide temperature range, high heat distortion temperature, low thermal conductivity, and excellent chemical resistance to a variety of aggressive substances. Well-balanced physical properties are crucial to ensure the material selected can handle anticipated system requirements. Harvel CPVC Corzan® Duct provides construction advantages due to the material's light weight, ease of fabrication, and other labor-saving characteristics. When combined with the longevity of a properly designed system, significant cost savings can be recognized. Refer to ***Table II*** for physical property details.

MATERIAL

Harvel CPVC Duct pipe is extruded from a light-gray-colored Chlorinated Polyvinyl Chloride (CPVC) compound with a Cell Classification of 23447 per ASTM D1784. This enables Harvel Duct to safely carry a maximum service temperature of 200˚F. Harvel CPVC Duct is chemically resistant to most acids, bases, salts, aliphatic solutions, oxidants, and halogens. Detailed chemical resistance data is available and should be referenced for proper material selection.

FIRE PERFORMANCE

In addition to chemical inertness and mechanical strength, Harvel CPVC Duct also has excellent flammability properties when compared to many common building products. Harvel CPVC Duct will not independently support combustion. Harvel CPVC Duct will not burn unless a flame is constantly applied and stops burning once the flame is removed. In addition to burn resistance, Harvel CPVC Duct has exceptionally low flame-spread and smoke-generation properties, and is listed by Underwriters Laboratories of Canada for surface burning characteristics. Refer to ***Table I*** for a list of flammability properties and test methods.

TABLE I

FIRE PERFORMANCE	Value	Test Method
Flammability Rating	V-0, 5VB, 5VA	UL-94
Flame Spread Index	<10	
Flame Spread	<25 <25	ASTM E-84/UL 723 ULC
Smoke Generation	≤ 50 <50	ASTM E-84/UL 723 ULC
Flash Ignition Temp.	900°F	
Average Time of Burning (sec.)	<5	ASTM D635
Average Extent of Burning (mm)	<10	
Burning Rate (in/min)	Self Extinguishing	
Softening Starts (approx.)	295°F	
Material Becomes Viscous	395°F	
Material Carbonizes	450°F	
Limiting Oxygen Index (LOI)	60	ASTM D2863
Clean Room Materials Flammability Test	FPI=1.20 SDI=0.09	FM 4910

TABLE II Physical Properties

GENERAL	Value	Test Method
Cell Classification	23447	ASTM D1784
Maximum Service Temp.	200°F	
Color	Medium Gray	
Specific Gravity, (g/cu.gm @ 73°F)	1.52 ± 0.02	ASTM D792
Water Absorption % increase 24 hrs @ 25°C	0.03	ASTM D570
Hardness, Rockwell	117	ASTM D785
Poisson's Ratio @ 73°F	0.38	
Hazen-Williams Factor	C = 150	
MECHANICAL		
Tensile Strength, psi @ 73°F	7,750	ASTM D638
Tensile Modulus of Elasticity, psi @ 73°F	360,000	ASTM D638
Flexural Strength, psi @ 73°F	13,000	ASTM D790
Flexural Modulus, psi @ 73°F	360,000	ASTM D790
Compressive Strength, psi @ 73°F	10,000	ASTM D695
Compressive Modulus, psi @ 73°F	196,000	ASTM D695
Izod Impact, notched, ft-lb/in @ 73°F	2.0	ASTM D256
THERMAL		
Coefficient of Linear Expansion (in/in/°F)	3.9×10^{-5}	ASTM D696
Coefficient of Thermal Conductivity (Cal.)(cm)(cm^2)(Sec.)(°C) BTU/in/hr/ft.^{2}/°F Watt/m/°K	 3.27×10^{-4} .95 0.137	ASTM C177
Heat Deflection Temperature Under Load (264psi, Annealed)	226°F	ASTM D648
ELECTRICAL		
Dielectric Strength, volts/mil	1,250	ASTM D149
Dielectric Constant, 60Hz, 30°F	3.70	ASTM D150
Volume Resistivity, ohm/cm @ 73°F	3.4×10^{15}	ASTM D257
Power Factor, 100Hz	0.007%	ASTM D150
Harvel CPVC Duct is non-electrolytic		

PRODUCT RATINGS AND CAPABILITY

Harvel CPVC Duct performs well when exposed to harsh environments. This was demonstrated by testing conducted at an independent test facility to determine critical collapse pressures. Harvel CPVC Duct was taken to extremes under various negative pressure conditions to validate the product's structural integrity at elevated temperatures when exposed to severe conditions. The negative pressure ratings shown in Table III are based on actual testing of CPVC Duct at various temperatures and incorporate a 1.5:1 safety factor.

Positive Pressure

Harvel CPVC Duct can endure greater levels of positive internal pressure than negative internal pressure. ***Table IV*** shows the maximum recommended internal pressure rating in PSI for Harvel CPVC Duct at various temperatures.

SYSTEM DESIGN AND INSTALLATION

Joining Techniques

Harvel CPVC Duct can be easily assembled in the field using standard thermoplastic-pipe joining techniques. The most common methods involve thermal hot-air welding or the solvent-cementing process. Both of these methods provide reliable, cost-effective joints. Other methods of joining and fabricating Harvel CPVC Duct and system accessories include thermoforming, extrusion welding, and hot-plate welding.

Solvent Cementing

Belled-end duct, couplings, flanges and other socket-style fittings can be joined using the solvent-cementing process. This process involves the application of a primer and solvent cement to join system components. This joining method has been used successfully for more than 45 years in tough corrosive pressure applications. When properly conducted, this method provides a strong, homogeneous joining area in which the mating surfaces are chemically fused together, producing a strong, leak-tight seal when cured. Detailed solvent- cementing procedures are available and should be referenced for proper installation techniques. Adequate surface-to-surface contact of the parts being joined is necessary for reliable solvent-cemented joints. Generally, a minimum socket depth of 3″ (all sizes) will provide sufficient joint strength for most systems. Since duct dimensional tolerances can be appreciable when compared to heavy wall pipe, the use of extra-heavy-bodied CPVC cement (such as IPS 729 or equivalent) is recommended due to the cement's excellent gap-filling properties. Care should be used when solvent- cementing duct diameters 18″ and larger to ensure tightness of fit of matting components. The solvent-cementing method is not recommended for any type of end-to-end joining.

TABLE III

MAX. Internal Negative Pressure Rating
Inches of Water @ Various Temperatures ˚F

SIZE	TEMPERTURE ˚F						
	73	***100***	***120***	***140***	***160***	***180***	***200***
6"	426	371	316	263	208	153	98
8"	193	168	143	118	93	70	45
10"	100	86	73	60	48	35	23
12"	60	51	43	36	28	20	13
14"	45	38	33	26	21	15	10
16"	30	26	21	18	13	10	6
18"	26	23	20	16	13	10	6
20"	28	25	21	16	13	10	6
24"	20	18	15	13	10	6	3

PSI = Inches of Water x .0361; Inches of Mercury = Inches of Water x .07355

TABLE IV

MAX. Internal Positive Pressure Rating
Inches of Water @ Various Temperatures ˚F

SIZE	TEMPERTURE ˚F						
	73	***100***	***120***	***140***	***160***	***180***	***200***
6"	70	56	45	35	26	16	13
8"	53	43	33	26	20	13	10
10"	43	35	28	21	16	10	8
12"	36	30	23	18	15	8	6
14"	33	26	21	16	13	8	6
16"	28	23	18	13	11	6	5
18"	25	20	15	11	10	5	5
20"	26	21	16	13	10	6	5
24"	25	20	15	11	10	5	5

NOTE: Maximum values stated are for extruded duct pipe only, and incorporate a 1.5:1 safety factor. Consideration should be given to system design, method of fabrication, and joining which may require additional system derating. The use of compressed air or gases is not recommended for use with Harvel PVC/CPVC Duct piping.

TABLE IV Maximum Hanger Support Spacing In Feet

SIZE	TEMPERTURE ˚F						
	73	***100***	***120***	***140***	***160***	***180***	***200***
6"	10	10	10	10	10	8	8
8"	10	10	10	10	10	8	8
10"	10	10	10	10	10	10	10
12"	10	10	10	10	10	10	10
14"	12	12	12	12	10	10	10
16"	12	12	12	12	12	10	10
18"	12	12	12	12	12	12	12
20"	12	12	12	12	12	12	12
24"	12	12	12	12	12	12	12

Thermal Welding

The hot-air welding technique utilizes clean hot air to preheat the duct material and CPVC welding rod, while pressure is applied to the weld area as the rod is guided. This joining method results in the surface molecules of the parts being joined to fuse together at the weld seam. Only welding rod produced from Corzan® CPVC material is recommended for this joining process to ensure the highest system integrity. All welding should be conducted by personnel adequately trained in the art of hot-air welding thermoplastics. Detailed information concerning Corzan® CPVC welding and fabrication is available.

Hangers and Supports

Harvel CPVC Duct requires fewer supports at elevated temperatures than other thermoplastic duct systems due to its exceptional heat resistance, a significant cost-savings advantage. Proper support spacing is dependent on the duct diameter, the temperature parameters of the system, the location of concentrated stress loads, and the possibility of process solids accumulation within the system. As with all piping systems, proper support spacing is critical to ensure that deflection and sagging are kept to a minimum. This prevents unnecessary stress on the system, and reduces the possibility of creating fluid condensation/collection areas. Drains must be installed where accumulation of moisture is expected and at low points in the system; these locations shall be specified on the drawings. The values stated in ***Table V*** are based on actual testing of air-filled duct at various temperatures, and incorporate a reasonable safety factor. Depending on the type of system service, consideration must be given to the possibility of solids accumulation within the line, particularly where two separate process lines intersect. (Solids can be created within a system as the result of a chemical reaction of the fumes being extracted.) Stress loads can be generated by the additional weight of accumulated solids, and this fact should be addressed with adequate system support where required. Proper system inspection, cleaning and maintenance should be enforced to prevent the formation of additional weight loads. Refer to Table V for maximum support spacing of horizontal air-filled duct at various temperatures.

As with any system, Harvel CPVC Duct must be independently supported at fans, flexible connections, hoods, scrubbers, tanks, and other system components to ensure the highest system integrity. In the case where flexible connections are installed as expansion joints, a suitable support or hanger shall be provided at each end of the flexible connection. Other heavy system components such as dampers, filters, etc. must also be independently supported to prevent high stress concentration areas. Hangers and supports shall be securely fastened to the building structure to avoid vibration, and should be installed in such a manner as to prevent conditions of stress on the system (properly aligned). Seismic design and construction practices for hangers and supports shall be followed where applicable.

Hangers selected shall have an adequate load-bearing surface free of rough or sharp edges, and shall not cause damage to the duct during use. The hangers and hanger hardware shall be of a corrosive-resistant material suitable for use in the system environment. Hangers are to be of a type that will not restrict linear movement of the system due to expansion and contraction. Overtightening must be avoided to prevent duct deformation and restriction of movement.

Reinforcement

Due to Harvel CPVC Duct's inherent rigidity and heat resistance, additional system reinforcements or flanges are not required for 6″ through 24″ sizes up to 160˚F and 10″ of negative internal static pressure, provided proper support spacing requirements are followed. Additional reinforcements are not required for systems under positive pressure.

Thermal Expansion and Contraction

The coefficient of linear expansion (y) for Harvel CPVC Duct is 3.9×10^{-5} in/in/˚F, the lowest thermal expansion rate of commonly used thermoplastics. As with all piping products, thermal expansion and contraction of the system must be considered and properly addressed during the design and installation of the system. The expansion or contraction rate of Harvel CPVC Duct can be calculated as follows:

$\Delta L = 12\ yL\ (\Delta T)$

where: ΔL = *expansion or contraction of duct in inches*

$y = 3.9 \times 10^{-5}$ *in/in/˚F (coefficient of thermal expansion)*

L = *Length of duct run in feet*

ΔT = *Temperature change ˚F (T max. - T in.)*

T max. = maximum change in operating temperature (˚F)

T in. = temperature at time of installation (˚F)

The most common means to compensate for changes in length is with the installation of in-line expansion joints, either flexible sleeve type or o-ring piston type being the most common. The effects of thermal expansion and contraction can also be compensated by using the inherent line flexibility of the system to construct expansion loops and offsets where required. Additional detailed information concerning the effects and control of thermal expansion and contraction, and other information pertaining to the design and installation of CPVC piping products, is available from Harvel Plastics, Inc.

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CPVC DUCT

Seamless extruded CPVC duct in sizes *6" through 24"* offers superior resistance to corrosion and chemical attack.

Harvel Corzan® CPVC Duct...

- resists chemical and corrosive attack, preventing expensive maintenance, replacement and downtime
- safely withstands temperatures up to 200°F, maintaining system integrity in aggressive environments
- provides consistent uniformity and reduced fabrication time with seamless extruded IPS sizes from 6" thru 24", eliminating the need to fabricate large-diameter duct from sheet.
- reduces labor and keeps installation costs down – lightweight, easily solvent-cemented or welded
- offers low flame and smoke generation characteristics

Harvel's advanced extrusion technology and new Lubrizol Corzan® engineered material have created a new generation of large-diameter duct with superior physical properties. Harvel Corzan® CPVC Duct safely handles most corrosive fume service applications involving mineral acids, bases, salts and aliphatic hydrocarbons at temperatures up to 200°F.

LARGE-DIAMETER DIMENSIONS

Harvel CPVC Duct is round, seamless extruded type, and is manufactured from 6" through 24" sizes to Iron Pipe Size (IPS) dimensions. Harvel's unique precision extrusion technology produces duct with consistent proportional stability, assuring that the mechanical integrity of the duct pipe remains uniform. Produced in IPS diameters, Harvel CPVC Duct piping has large internal flow areas that can easily be adapted to other common IPS CPVC fittings, reducing fabrication and installation time.
Harvel CPVC Duct strictly conforms to the dimensions shown here.

SIZE	AVG OD	AVG OD TOL.	O of R TOL.	MIN. WALL	AVG WALL	MAX WALL	WT(lbs) PER FT
6"	6.625	+/- .020	+/- .050	.172	.187	.202	2.555
8"	8.625	+/- .020	+/- .075	.172	.187	.202	3.349
10"	10.750	+/- .025	+/- .075	.172	.187	.202	4.192
12"	12.750	+/- .025	+/- .075	.172	.187	.202	4.986
14"	14.000	+/- .030	+/- .075	.172	.187	.202	5.485
16"	16.000	+/- .030	+/- .075	.172	.187	.202	6.273
18"	18.000	+/- .040	+/- .080	.172	.187	.202	7.580
20"	20.000	+/- .070	+/- .140	.199	.219	.239	9.146
24"	24.000	+/- .090	+/- .180	.230	.250	.270	12.536

O of R = Out of Roundness Factor at time of extrusion

STORAGE AND HANDLING

Reasonable care and common sense should be used when handling and storing Harvel Corzan® CPVC Duct piping. Although Harvel Duct is tough and corrosion resistant, it should not be dropped or have objects dropped on it. Care should be used when transporting and storing duct to prevent physical distortion. The duct should not be stored close to heat-producing sources, subjected to external loads (i.e., heavy objects, overstrapping etc.) or overstacked when stored. When stored outdoors, Harvel CPVC Duct must be covered with a non-transparent material to reduce the risk of heat absorption and discoloration. The product should be inspected for any scratches, splits or gouges that may have occurred from improper handling; if found, these sections must be cut out and discarded.

SYSTEM COMPONENTS

Fittings fabricated from Harvel Corzan® CPVC Duct are readily available in most configurations. To maintain system integrity, consistency, and compatibility, all duct fittings, fume hoods, fume scrubbers, fans, blast gates and other system components should be fabricated from Corzan® CPVC sheet or duct material of the same wall thickness. Additional information concerning Corzan® CPVC Duct fittings and other system components can be obtained by contacting: **Harvel Plastics Inc. at 610-252-7355 or Lubrizol Advanced Materials at 216-447-5000.**

REFERENCES

Additional engineering and fabricating information can be obtained from:

1. PVC/CPVC Piping Product Bulletin 112/401; Harvel Plastics, Inc.
2. Corzan® Engineering Design Manual; Lubrizol Co., 9911 Brecksville Road, Cleveland, OH 44141-3247
3. Handbook for Welding and Fabricating Thermoplastic Materials; S.J. Kaminsky and J.A. Williams, Kamweld Products Co., Inc., 90 Access Road, PO Box 91, Norwood, MA 02062
4. Thermoplastic Duct (PVC) Construction Manual; SMACNA, 4201 Lafayette Center Drive, Chantilly,VA 22021

SAMPLE SPECIFICATION

All exhaust duct piping, sizes 6" through 24" shall be CPVC seamless extruded type, as manufactured by Harvel Plastics, Inc.; trade name Harvel® Corzan® CPVC Duct. Exhaust duct shall be extruded from a Type IV, Grade I Chlorinated Polyvinyl Chloride (CPVC) compound with a cell classification of 23447 per ASTM D1784; trade name CPVC. All extruded duct shall have a maximum flame spread rating of 25 or less and a maximum smoke generation of 50 or less per ULC S102.2. All extruded duct shall meet Harvel Plastics, Inc. published standards with regard to material and dimensions, and carry a maximum temperature rating of 200°F. All extruded duct pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer, and shall be stored indoors at the manufacturing site until shipped from the factory. All extruded CPVC duct pipe shall be marked with the manufacturing name or identifying symbol, and the CPVC material trademark.

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