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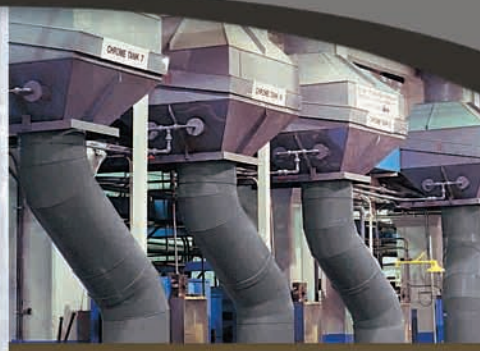
HARVEL®

PVC DUCT

A long-lasting,
cost-effective solution
for industrial and institutional
corrosive fume exhaust
and drain applications.



THE QUALITY LINE

HARVEL® PVC DUCT

Harvel PVC Duct, available in 6" through 24" diameters, provides long-lasting, cost-effective solutions for industrial and institutional corrosive fume exhaust and drain applications.

Physical Properties

Harvel PVC Duct systems perform well in many aggressive environments that are not suitable for other types of materials. Due to the unique properties of the PVC material, Harvel PVC Duct maintains high tensile strength and modulus over a moderate temperature range, low thermal conductivity, good electrical properties, 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. Appropriate construction practices are determined and applied based on the physical properties of the material selected. Harvel PVC Duct provides construction advantages due to the material's inherent corrosion resistance, 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.

Materials

Harvel PVC Duct pipe is extruded from Harvel's own custom blend of dark-gray-colored Type I, Grade I, Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784 (PVC 1120); trade name H707 PVC. Harvel PVC Duct can safely carry a maximum service temperature of 140°F. Harvel PVC Duct is chemically resistant to most acids, bases, salts, aliphatic solutions, oxidants, and halogens. Unlike metallics, vapor phase or liquid-vapor phase corrosion is generally less aggressive with thermoplastics than the liquid phase corrosion. When in question, testing must be conducted under actual use conditions to verify compatibility. Detailed chemical resistance data is available and should be referenced for proper material selection.

Physical Properties

GENERAL	value	test method
Cell Classification	12454	ASTM D1784
Specific Gravity	1.40°F	ASTM D792
Color	Dark Gray	
Water Absorption		
% increase 24hrs. @ 25°C	.05%	ASTM D570
Hardness, Rockwell	110-120	ASTM D785
Poisson's ratio @ 73°F	.410	
Hazen-Williams Factor	C = 150	
MECHANICAL		
Tensile Strength, psi @ 73°F	7,450	ASTM D638
Modulus of Elasticity, psi @ 73°F	420,000	ASTM D638
Flexural Strength, psi @ 73°F	14,450	ASTM D790
Compressive Strength, psi @ 73°F	9,600	ASTM D695
Izod Impact, ft-lb/in @ 73°F	.75	ASTM D256
THERMAL		
Coefficient of Linear Expansion		
(in/in/°F)	2.9×10^{-5}	ASTM D696
Coefficient of Thermal Conductivity		
(Cal.)(cm)/(cm^2)(Sec.)(°C)	3.5×10^{-4}	
BTU/in/hr/ft/°F	1.02	
Watt/m/°K	.147	ASTM C177
Heat Distortion Temperature,		
°F @ 264 psi	170	ASTM D648
Specific Heat, Cal/°C/gm	.25	ASTM D2766
ELECTRICAL		
Dielectric Strength, V/mil	1,413	ASTM D149
Dielectric Constant 60Hz, 30°F	3.7	ASTM D150
Volume Resistivity, ohm/cm @ 73°F	1.2×10^{12}	ASTM D257
Harvel PVC Duct is non-electrolytic		
FIRE PERFORMANCE		
Flammability Rating	V-0	UL 94
Flame Spread Index	<10	ASTM E162
Flame Spread	0-25	ULC
Smoke Generation	80-225	ULC
Flash Ignition Temperature	730°F	
Average Time of Burning, Sec.	<5	ASTM D635
Average Extent of Burning, mm	<10	
Burning Rate (in/min)	Self-Extinguishing	
Softening Starts (approx.)	250°F	
Material Becomes Viscous	350°F	
Material Carbonizes	425°F	

Fire Performance

In addition to chemical inertness and mechanical strength, Harvel PVC Duct also has good flammability properties when compared to many common building products. Unlike other types of plastics, Harvel PVC Duct will not independently support combustion; it will not burn unless a flame is constantly applied and stops burning once the flame is removed. Refer to Table I for a list of flammability properties and test methods.

Product Ratings and Capability

Harvel PVC Duct performs well when exposed to harsh environments. Harvel PVC Duct has been taken to extremes under both various negative and positive pressure conditions in applications as diverse as laboratory work and industrial metal finishing operations. The ratings shown in the tables incorporate a 1.5:1 safety factor.

Harvel PVC Duct can endure greater levels of positive pressure and than negative pressure. Refer to Table I and Table II for maximum recommended pressure ratings of Harvel PVC Duct at various temperatures for both positive pressure (psi) ,and negative pressure (inches of water), applications.

System Design and Installation

Joining Techniques

Harvel PVC 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 PVC Duct and system accessories include thermoforming, fusion 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 reliable field-proven joining technique has been used successfully for many 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 PVC cement (such as IPS 719 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.

Thermal Welding

The hot-air welding technique utilizes clean hot air to preheat the duct material and PVC 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 the same virgin PVC material (Cell Classification 12454 per ASTM D1784) is recommended for this joining process to ensure the highest system integrity. Personnel adequately trained in the art of hot-air welding thermoplastics should conduct all welding.

Hangers and Supports

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

Table I – MAX. Internal Negative Pressure Rating

Inches of Water @ Various Temperatures °F

SIZE	TEMPERATURE °F							
	73	80	90	100	110	120	130	140
6" x 1/8	115	101	86	71	59	46	36	25
6"	415	365	311	257	212	166	129	91
7"	301	265	226	187	153	120	93	66
8"	188	166	141	117	96	75	58	41
9"	146	129	110	91	75	59	45	32
10"	97	85	73	60	50	39	30	21
11"	82	72	61	51	42	33	25	18
12"	58	51	44	36	30	23	18	13
14"	44	39	33	27	22	18	14	10
16"	29	26	22	18	15	12	9	6
18"	21	18	16	13	11	8	6	4
20"	24	21	18	15	12	10	7	5
24"	21	18	16	13	11	8	6	4

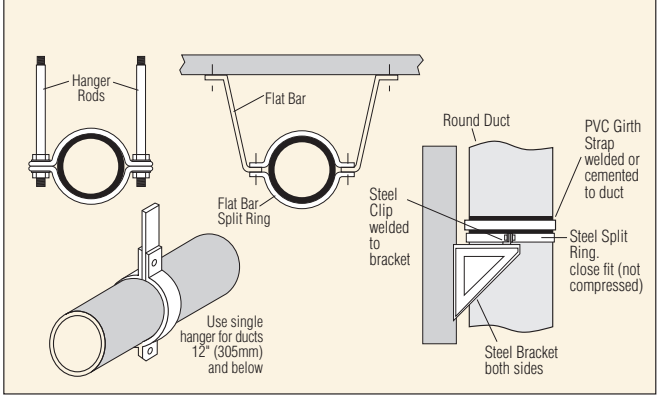
PSI = Inches of Water x .0361; Inches of Mercury = Inches of Water x .07355

Table II – MAX. Internal Positive Pressure Rating

PSI @ Various Temperatures °F

SIZE	TEMPERATURE °F							
	73	80	90	100	110	120	130	140
6" x 1/8	42	37	31	26	21	17	13	9
6"	70	62	52	43	35	28	22	15
7"	64	56	48	40	32	25	20	14
8"	53	47	40	33	27	21	16	12
9"	74	65	55	46	38	29	23	16
10"	43	39	32	27	22	17	13	9
11"	61	53	46	38	31	24	19	13
12"	36	32	27	22	18	14	11	8
14"	33	29	25	20	17	13	10	7
16"	28	25	21	17	14	11	9	6
18"	25	22	19	15	13	10	8	5
20"	26	23	20	16	13	10	8	6
24"	25	22	19	15	13	10	8	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.



points in the system; these locations shall be specified on the drawings. The values stated in the table 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. See table for

Maximum Hanger Support Spacing In Feet

SIZE	TEMPERATURE °F							
	73	*80*	*90*	*100*	*110*	*120*	*130*	*140*
6" x 1/8	9.5	9	9	8.5	8	7.5	7	6.5
6"	10	10	9.5	9	8.5	8	7.5	6.5
7"	10	10	9.5	9	8.5	8	7.5	7
8"	10	10	10	10	9	9	8	7.5
9"	10	10	10	10	10	9	8.5	8
10"	10	10	10	10	10	10	9	8.5
11"	10	10	10	10	10	10	9.5	9
12"	12	12	12	12	10	10	10	9.5
14"	12	12	12	12	11.5	11.5	11	10
16"	12	12	12	12	12	12	11	10
18"	12	12	12	12	12	12	11.5	11
20"	12	12	12	12	12	12	12	11.5
24"	12	12	12	12	12	12	12	12

maximum support spacing of horizontal air-filled duct with an allowable 1/8" deflection at various temperatures.

As with any system, Harvel PVC 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 PVC Duct's inherent rigidity, additional system reinforcements or flanges are not required for 6" through 24" sizes (.187" average wall or higher) up to 100°F and 10" of negative internal static pressure, provided proper support spacing requirements are followed. Reinforcements are not required for systems under positive pressure when standard support spacing requirements are followed.

Thermal Expansion and Contraction

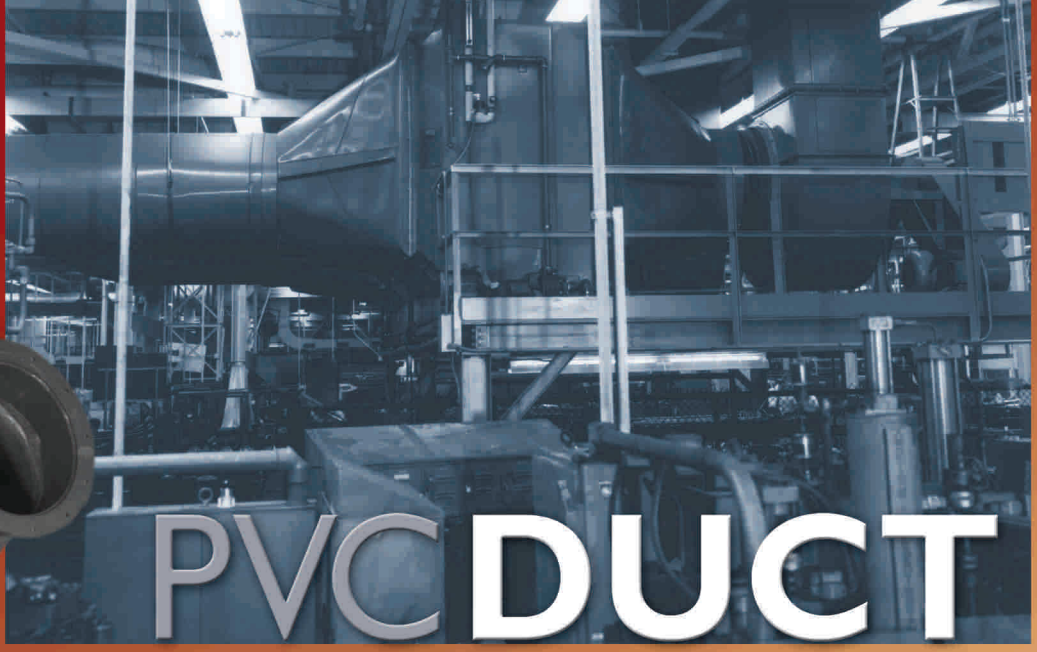
The coefficient of linear expansion (y) for Harvel PVC Duct is 2.9 x 10^{-5} in/in/°F. As with all piping products, thermal expansion and contraction of the system must be considered and properly addressed during the design and installation of the system. The expansion or contraction rate of Harvel PVC Duct can be calculated as follows:

$\Delta L = 12\ y L (\Delta T)$
where: ΔL = expansion or contraction of duct in inches
y = 2.9 x 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 PVC piping products, is available from Harvel Plastics, Inc.

Storage and Handling

Reasonable care and common sense should be used when handling and storing Harvel PVC Duct piping. Although Harvel Duct is tough and corrosion resistant, it should not be dropped nor 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 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.



PVC DUCT

Product Benefits

- *Exceptional chemical resistance to a broad spectrum of corrosive fumes, gases and fluids*
- *Seamless, large-diameter extrusions provide consistent surface smoothness, uniformity and dimensional stability*
- *Light weight eases fabrication, handling, and installation – reducing installation costs*
- *Long system service life*
- *Lower overall installed cost*

Large Diameter Dimensions

Harvel PVC seamless round duct is extruded in 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 remains uniform. Produced in IPS diameters, Harvel PVC Duct piping has large internal flow areas that can easily be adapted to other common IPS PVC fittings, reducing fabrication and installation time. For space considerations in congested areas such as pipe chases, additional ID sizes are available in 7", 9" and 11" diameters. Harvel PVC Duct strictly conforms to the following dimensions:

SIZE	AVG. OD	AVG OD TOL.	O of R TOL.	MIN. WALL	AVG. WALL	MAX. WALL	WT(lbs) PER FT.
6" x 1/8	6.625	+/- .020	+/- .050	.105	.122	.140	1.530
6"	6.625	+/- .020	+/- .050	.172	.187	.202	2.275
7"	7.375	+/- .020	+/- .050	.172	.187	.202	2.534
8"	8.625	+/- .020	+/- .075	.172	.187	.202	2.982
9"	9.375	+/- .025	+/- .075	.172	.187	.202	3.239
10"	10.750	+/- .025	+/- .075	.172	.187	.202	3.733
11"	11.375	+/- .025	+/- .075	.172	.187	.202	3.944
12"	12.750	+/- .025	+/- .075	.172	.187	.202	4.440
14"	14.000	+/- .030	+/- .075	.172	.187	.202	4.884
16"	16.000	+/- .030	+/- .075	.172	.187	.202	5.586
18"	18.000	+/- .040	+/- .080	.172	.187	.202	6.750
20"	20.000	+/- .070	+/- .140	.199	.219	.239	8.144
24"	24.000	+/- .090	+/- .180	.230	.250	.270	11.163

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

Other Design Considerations

Proper system engineering, design, construction practices, and operation are the responsibility of the design authority. Consideration must be given to ensure the duct system is not exposed to any conditions that will exceed the product limitations regarding temperature, pressure, chemical compatibility and mechanical strength. Care must be taken to ensure that fume hood design, capture velocities, flow velocities, and flow volumes are adequate to properly convey the corrosive fumes being extracted while maintaining safety to personnel and protection of other equipment from corrosive attack. An optimum velocity for most systems is 1,500 feet per minute (FPM), which allows for future expansion of the system by increasing the fan size. With the exception of some heavy metals extraction, velocities exceeding 3,000 FPM are generally not recommended; particularly for solid particles as static electricity becomes a concern. Minimum exhaust volume requirements, usually expressed in cubic feet per minute (CFM), must be calculated based on the type and concentration of fumes being extracted. The system should also be designed and routed to provide sufficient access for inspection and future equipment maintenance. Size transition sections in mains and submains should be tapered appropriately to maintain optimum flow conditions. A general recommendation is to provide a minimum taper of 5" in length for each 1" change in duct diameter. Branches shall enter the main at the large end of the transition at angles not exceeding 45°. Branches shall not enter the main diametrically opposite one another. It is the responsibility of the design authority to ensure the system is designed in compliance with any applicable pollution control and/or building codes.

System Components

Fittings fabricated from Harvel PVC 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 PVC sheet or duct of the same wall thickness, and from materials that conform to ASTM D1784. Additional information concerning PVC Duct fittings and other system components can be obtained by contacting Harvel Plastics, Inc.

SAMPLE SPECIFICATION

All exhaust duct piping, sizes 6" through 24", shall be PVC seamless extruded type, as manufactured by Harvel® Plastics Inc. – No Equal. This duct pipe shall be extruded from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784, trade name H707 PVC. All extruded PVC duct shall have a maximum flame spread rating of 25 or less per ULC S102.2. All PVC extruded duct pipe shall meet Harvel Plastics Inc. published standards with regard to material and dimensions, and shall carry a maximum temperature rating of 140°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 PVC duct pipe shall be marked with the manufacturer's name or identifying symbol.

HARVEL® PLASTICS, INC.

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REFERENCES

1. PVC/CPVC Piping Product Bulletin 112/401; Harvel Plastics Inc.
2. 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
3. Thermoplastic Duct (PVC) Construction Manual; SMACNA, 4201 Lafayette Center Drive, Chantilly, VA 22021

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