مصنع الصناعات المتميزة
Innovative Manufacturing

المملكة العربية السعودية
حريملاء 15436 - 16896 الرياض

مصنع الصناعات المتميزة

Innovative Manufacturing

TACHNICAL SUBMITTAL

FOR
PRE-INSULATED ALUMINIUM DUCTING SYSTEM
FOR HVAC

Project name ……..

……..

Consultant ……..

……..

Item **Per insulated IM have ducting system**

Manufacturer **IM innovated manufacturing**
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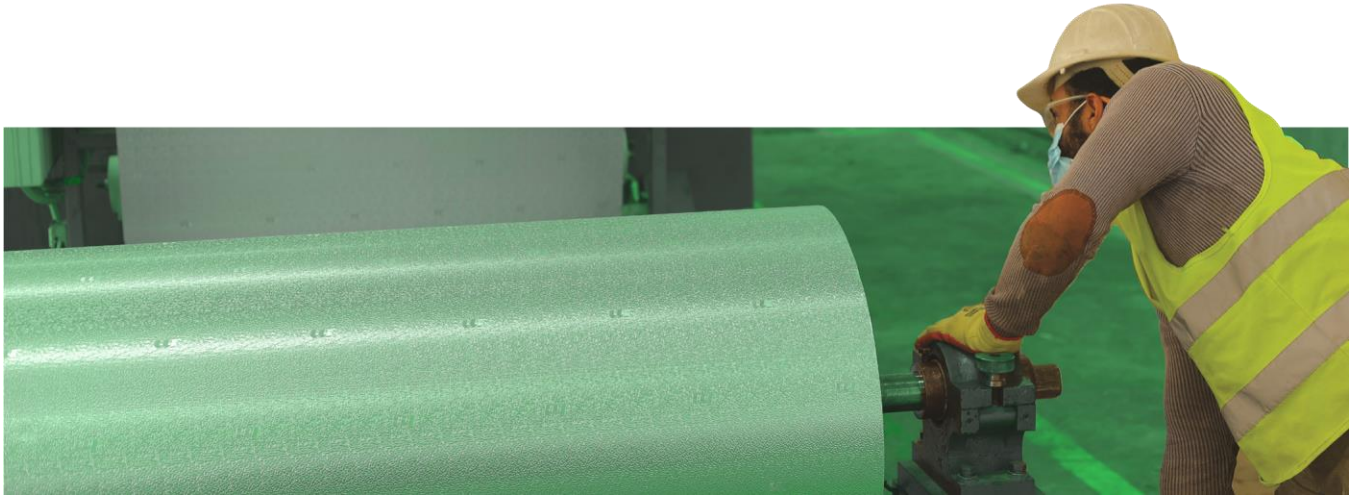
حياكم


مصنع الصناعات المتميزة
Innovatiive Manufacturing

المقدمة | Introduction

يفتخر مصنع الصناعات المتميزه ان يشارك بجزء صغير فى تطوير صناعه البناء
والمساهمه فى تحقيق رؤيه المملكه 2030 للارتقاء بمعايير الجوده والاستدامه ومطابقه اعلى المواصفات العالميه .وذلك بتقديم اخر ماتوصلت اليه العلوم فى تصنيع الواح العزل الحرارى للمبانى والواح قنوات التكييف المسبق العزل لتصنيع قنوات التكييف (الدكت)
وتعمل اداره المصنع على تطوير منتجاتها واجراء البحوث والتجارب .للمساهمه فى تخفيض تكاليف البناء فى العازل وتوفير استهلاك الطاقه باستخدام العزل الحرارى والدكت المسبق العزل .
وحرصا من اداره المصنع على تقديم افضل المنتجات للعملاء فقد حصل المصنع على شهاده الايزو فى اداره الجوده وعلى شهاده الجوده والمطابقه (ساسو)
وتعمل اداره المصنع على فحص عينات المنتجات بشكل دورى فى مختبر المصنع وكذلك فى مختبرات اكسوفا البريطانيه ومختبرات هيئه المواصفات والمقاييس السعوديه .



We are pleased to submit and sharing our valuable innovative IM pre insulated HAVC products and knowledge with others. For better performance of the building industry. IM preincubated duct system for heating ventilation and air conditioning.

مصنع الصناعات المتميزة
Innovatiive Manufacturing

تم إنشاء مصنع الصناعات المتميزه في بداية عام

2008

يقع المصنع في
مدينة الرياض

يغطي مساحة
8500
متر مربع

InnovatiiveManufacturing

الشركه المصنعه

تـم إنشـاء مصنـع الصناعـات المتميـزه في بدايـة عـام 2008. يقـع المصنـع الـذي يغطـي مسـاحة 8500 متر مربـع في مدينـة الريـاض بالمملكـة العربيـة السـعودية ، وتشـمل المرافـق. خـط التصنيـع والمخـازن والمبيعـات والتسـويق .مصنـع الصناعـات المتميـزه هـو واحـد مـن المصانـع الوطنيـه الرائـده فى المملكـه العربيـه السـعوديه لتصنيـع الالـواح العازلـه للحـراره والالـواح المغلفه بورق الالومنيوم من ماده
(البولى ايزو سيانات) لتصنيع قنوات الهواء باحدث ماتوصلت اليه التقنيه .

ABOUT MANUFACTURER

Innovative manufacturing established at the beginning of 2008. The factory, which covers a surface area of 8500 sqm., is located in Riyadh ,Saudi Arabia .Facilities include. Manufacturing line, warehouse, sales and marketing.
Innovative Manufacturing factory Im is one of the leading manufacturer of high quality Polyisocyanurate (PIR) thermal insulation panels and aluminum foil panels for duct construction using the most advanced technology in HVAC systems . IM offers a complete line of system technology approach for pre-insulated duct works. We also offer a complete line of accessories for fabrication and installation of the system.

VISION & MISSION

رسالتنا

المشاركه بشكل فاعل فى تعزيز وتطوير النهضه الاقتصاديه التى تعيشها المملكه ومساهمه فى تحقيق رؤيه المملكه 2030 وذلك عن طريق الخبرات العلميه والفنيه التى نمتلكها فى مجال صناعه منتجات العزل الحرارى وتوظيف جميع امكانياتنا فى الحفاظ غلى ثقه عملائنا وجوده منتجاتنا للمنافسه محليا ودوليا .

رؤيتنا

أن نكون الشركة المصنعة الأفضل لالواح العزل الحرارى والواح العزل المغلفه بالالومنيوم لتزويد عملائنا من مقاولين ومصنعين قنوات الهواء مسبقه العزل والقنوات الهوائيه الطبيه باحدث وافضل المنتجات. نطمح دائمًا لبناء شراكات وعلاقات طويلة الأمد مع عملائنا وموردينا

Our Mission

Highly effective participation in support and development of economical progression currently witnessed by Saudi government

Through scientific and technical experience we possess in the field

Of insulation industry

Our Vision

To be the best quality manufacturer of insulation and Pre insulated Ducting panels .

continued objective is to supply our customers with a high end product in exceptional quality at a fair market price. We will always aspire to build partnerships with our customers, employees and suppliers long standing relationships. We commit to doing this by making the following promises:

لعملائنـــا | To Our Customers

نعـد بتزويـدك بمنتجـات عاليـه الجـوده ومسـتوى خدمـات تليـق بكم لهذه المنتجات .

We promise to provide you with top quality insulation and HVAC ducting panels.

لبيئتـــنـــا | To Our Environment

نحـن نعـد بـأن نعمـل دائمًـا بمسـؤولية تجـاه بيئتنـا وأن نقـدم منتجات صديقة للبيئة.

promise to always act responsibly to our environment.

لمنافسينا | To Our Competitors

التنافـس دائمـا بنزاهـه وامانـه لتقديـم منتجـات وخدمـات افضل للسوق .

To always compete with integrity, fairness and honesty.

منتجـاتنـــا

OUR PRODUCT

الواح قنوات التكييف المسبقه العزل (اميز®)

إستخدامات

الواح قنوات التكييف المسبقه العزل (اميز®)

يتـم تصنيـع الألواح(اميـز) الالعازلـة المغطـاه مـن كلا الجانـبين بـورق الألمنيـوم لاغـراض عمـل قنـوات الهـواء المسـبقه العـزل من عديد البولى سانيورات ويتم تصنييع المنتجات تحت المواصفات الامريكيه والاوربيه والبريطانيه .

نظام قنوات IM :

ان نظـام قنـوات الهـواء مسـبقه العـزل تسـتخدم الواح(اميـز) سـاندويتش مصنوعـة مـن رغـوة خاليـة مـن مركبـات الكربـون الكلوريـة فلوريـة ، ومركبـات الكربـون الهيدروكلوريـة فلوريـة ، ومركبـات الكربـون الهيدروفلوريـة ، كثافتهـا: 45 كجـم / م 3 تقريبـا مرتبطـة بالحـرارة على كلا الجانـبين بـورق الألمنيـوم سـمكه 60 /60 ميكـرون مـن كلا الجانـبين وسماكـه 20مـم للاسـتخدام الـداخلى و 200/60 ميكـرون وسماكـه 30مـم للاسـتخدام الخارجـى .و الموصليـة الحراريـة للالـواح 0.022 واط /م.ك . كما ان رقائـق الألمنيـوم الخارجيـه مطليـة بطبقـة طلاء إيبـوكسي مقاومـة للعوامـل الجويـة والأشـعة فـوق البنفسـجية لمنـح عملائنـا أقصى درجات الجودة في مشاريعهم.

Our Product

IM panels(imis) manufactured from Polyisocyanurate , polyurethane and phenolic foam Panel is covered on both sides by aluminum foil manufactured by a continuous Process production line. Im duct and insulation panels are manufactured under American (ASTM) as well as British Standards (BS).

Chemical composition of Im duct and insulation panels is in accordance with European Standards (EN 573-3).

The mechanical characteristics of aluminum foil that covers Im duct and insulation panels Tested in accordance with the European Standards (EN465-2).

إستخدامات

الواح اميز من IM فى تصنيع قنوات الهواء

حرصـا مـن المصنـع فى تطويـر اسـتخدام قنـوات الهـواء المسـبقه العـزل والتـى تتمتـع بمواصفـات قياسـيه عالميـه . قـام المصنـع بعمـل ورش تدريـب لـكل مـن يرغـب فى العمـل فى هـذا المجـال وتـامين وتجهيـز جميـع احتياجاتهـم مـن المـواد والمعـدات اللازمـه لتصنيـع قنـوات الهـواء المسـبقه العـزل وفقـا للمواصفـات العالميـه ويتـم اعطـاء المتـدرب شـهاده تفيـد بامكانيته الفنيه على تصنيع قنوات الهواء المسبقه العزل وانه اتم التدريب بنجاح .

USE OF IMIS PANELS to produce im ducting system THE IM DUCT SYESTEM PRODUCT

The system is fabricated using IM PIR sandwich panels and specific accessories. This **technology, named IMIS SYSTEM, has been considered a revolutionary innovation in the HVAC** field.

IM SYSTEM pre-insulated duct can be adapted to meet every needs in HVAC installations.

IM pre-insulated duct system can be installed either outdoor or indoor.

Installed in more than 1500 projects around the ksa, in almost all the HVAC sectors, from residential to commercial, from food processing to pharmaceuticals and hospitals.

IM is definitively the ideal solution for any HVAC project.

IM pre-insulated system comply with the strict national and international standards for these types of products and comply with all the international installation standards, such as SASO ,ASHRAE, SMACNA, etc.

IM is an ISO 9001 and SASO Quality Certified Manufacturer, to ensure a reliable process in meeting the most requirements .

مميزات نظام قنوات الهواء من IM

IM DUCT SYSTEM CARACTARISTICS

معمره

الميـزة الرئيسـية لمنتـج نظـام قنـوات الهـواء مـن مصنـع الصناعـات المتميـزه هـى عمرهـا الطويـل ومتانتهـا المسـتمده مـن خصائص المواد المصنعه للالواح مما يمنح القنوات عمر فعلى لاكثر من 25 سنه .

Long life

The main advantage of IM duct system product is their durability and their long life. The characteristics of stability, and physically derive from the unique properties of the insulating foam produced by IM in combination with the typical properties of the aluminum. IM System duct system can grant excellent working performances for more than 25 years.

وزن خفيف

نظام مجاري الهواء IM خفيف الوزن للغاية ، أخف بحوالي 8 مرات من مجاري الهواء المعدني.

تتمثـل ميـزة نظـام مجـاري الهـواء IM فـيما يتعلـق بخفتـه في التخفيـض الكـبير في الأحمال على الهيـاكل الناتجـة عـن استخدامه.

Light weight

IM duct system are extremely light weight, about 8 times lighter than G.I ductwork.

Advantage of IM duct system in relation to its lightness is the considerable reduction of the loads on structures that derives from its use.

جودة الهواء

الألمنيـوم ، المعـروف بأنـه مـادة غير سـامة ذات مقاومـة عاليـة للتـآكل ، يضمـن الحفـاظ على نقـاء الهـواء المـزود. هـذا هـو السـبب في أنـه يمكـن تركيـب نظـام قنـوات الهـواء IM بسـهولة في أي مشروع (منـزل .حضانه.مستشفى.مدرسـه .سـينما قاعه احتفالات .....الخ).

Air quality

The aluminum, well-known as non-toxic material with high resistance to corrosion, assures the preservation of the purity of the supplied air. This is the reason why IM duct system can be easily installed in any project.

تسرب الهواء

تمنـح نظـام قنـوات الهـواء احـكام تـام مـن تسريـب الهـواء مما يسـاعد على تخفيـف الاحمال عـن اجهـزه التكييـف وتـوفير الطاقه .

Air leakage

The special fabrication method of IM duct system grants a “totally sealed” duct system;

العزل الحرارى

في تركيبـات التدفئـة والتهويـة وتكييـف الهـواء ، يتـم عـزل مجـاري الهـواء مـن الصـاج عـن طريـق تطبيـق مـادة عازلـة خـارج مجـاري الهـواء. المـواد العازلـة الأكثر اسـتخدامًا في مجـال التدفئـة والتهويـة وتكييـف الهـواء هـي الصـوف الزجاجـي. بصرف النظـر عـن تكلفـة المادة نفسـها ، يلـزم القيـام بـأعمال إضافيـة لتركيـب العـزل خـارج مجـاري الهـواء ثـم عـزل الوصلـة بعـد التثبيت. فى قنوات الهواء المصنعه بالواimlا لاتحتاج الى اى خطوات اخرى للعزل.

Insulation

In HVAC installations, the insulation of the ductwork is carried out by applying an insulating

material outside the ductwork. The most used insulation material in HVAC field is Glass wool.

Apart the cost of the material itself, additional works are required to install the insulation outside the ductwork and then to insulate the joint after the installation. in IM system the insulation is an integral element of the duct structure, this is the reason why IM is known as the pre- insulated duct system .

(duct already insulated and no additional work required to insulate and to insulate the joints after the installation)

قيمة العزل

تعـتبر قيمـة العـزل الألـواح أفضـل بالتأكيـد مقارنـة بقيمـة أي منتجـات أخـرى تسـتخدم تقليديًـا لعـزل قنوات الهواء .

مـن المعـروف أن الـواح اميـز هـو أفضـل مـادة عازلـة متوفرة في السوق.

مـن المشـاكل الرئيسـية للصـوف الزجاجـي متانتـه ، حيث تقل سماكته بمرور الوقت.

على العكـس مـن ذلـك تمنـح الخلايامـن رغـوة البـولي يوريثـان الصلبـة وبنيتهـا الكيميائيـة الخاصـة أداء الاسـتقرار والعـزل لـفترة طويلـة مـن الزمـن ، أي لأكثر من عامًا.

Insulation value

The insulation value of IM panels is definitely

better in comparison with the value of any other products traditionally used for the insulation of HVAC ducts.

Pir is known to be the best insulating material available in the market. The same insulation value of 50 mm thick Glass wool can be easily achieved by about 20 mm of im pir foam.

One of the major problems of glass wool is its durability, as the thickness reduces with the

passing of time.

On the contrary, the rigid pir is extremely stable.The close cells of the rigid polyurethane foam and its particular chemical structure grant stability and insulation performances for a long period of time, i.e. for more than 25 years.

جوده العزل

في نظـام قنـوات الهـواء المسـبقه العـزل، يكـون العـزل مسـتمرًا وثابتًـا في جميـع نقـاط القنـاة ، خاصـة في الزوايـا .امـا فى قنـوات الهـواء المصنوعـه مـن الصـاج حيـث يتـم "ضغـط" الصـوف الزجاجـي عـادةً إلى الحـد الأدنى مـن السماكـة ، مما يفقـده الكثير من خصائص العزل الخاصة به.

Even insulation

In IM duct system the insulation turns out to be continuous and steady in all points of the duct, especially on the corners where glass wool is normally “squeezed” to a minimum thickness, then losing its insulation properties.

مقاوم للرطوبة

تتميز بنية الخلية المغلقة برغوة البولي إيزوسيانورات بمقاومة ممتازة لامتصاص الرطوب
بالإضافه الى رقائق الألومنيوم التي تغطي الألواح تعمال بمثابة مانع تبخر .

Moisture resistance

The close cell structure of the pir foam has excellent resistance Moisture absorption.
Aluminum foil covering the panels acts as Vapor barrier.

الصحه والسلامة

لا تطلق الواح المستخدمه فى تصنيع قنوات الهواء أي أليـاف او غبار اوعوالق فى الهواء مما يحافظ على صحه المستخدمين وكذلك العاملين . يمكن للألياف المنبعثة من الصوف الزجاجي أن تلوث الهواء المحيط ، مما يؤدي إلى مشاكل صحية لشاغلي المبنى أو التأثير على العاملين فى عمليات تصنيع قنوات الهواء الصاج .

Air safety

what happens in Glass wool, the pir foam does not release any fiber The fibers released by the

Glass wool can contaminate the ambient air, creating health problems to the occupants of the building or damaging/affecting industrial manufacturing processes.

مميزات استعمال نظام قنوات IM في الاجواء الخارجيه .

لتركيب قنوات الهواء من الحديد ، . تتطلب عمل عزل اضافى لتحمل الاجواء الخارجيه كذلك تحتاج لتلبيسها برقائق الالومنيوم لحمايه العزل من الاجواء الخرجيه .
لا يحتاج نظام المسبق العزل إلى اى اضافه للعزل او للحمايه الاضافيه بواسطة رقائق الألومنيوم السميكة التي تغطي عزل الصوف الصخرى المغلف ل هواء الصاج .
لذلك يعتبر نظام قنوات الهواء الخارجى لدينا ،يساهم فى التوفير في تكلفة المواد (لا يتطلب تكسيه اضافيه) وبالتالى توفير في تكلفة المشروع.

Outdoor IM duct advantage

For installation outdoor, when insulated, G.I. ductwork require cladding

My system doesn't require cladding granted by the thick aluminum foil covering the insulation foam. This allows the outdoor installation of our duct system without the need of additional materials and works, then:

1-Saving in materials cost (doesn't require cladding) 2-Reducing project costs.

مقاومة العوامل الجويه

تتميز ألواح مصنع الصناعات المتميزه ، بمقاومة عالية للتآكل ، تضمن سلامة نظام قنوات الهواء ضد العوامل الجويه القاسيه والمقاومه العاليه للاملاح والمواد الكيميائيه . هذه الخاصية مهمة جدا لتلك المنشآت القريبة من البحر والبيئه عاليه الرطوبه .

Wither resistance

IM panels aluminum, is high resistance to corrosion, assures the integrity of the duct system against the aggressive action of salty atmosphere. This characteristic is very important for those installations close to the sea.

تصنيع وتجهيز قنوات الهواء.

ميزة أخرى رائعة لنظام قنوات الهواء هي مرونتها فى التصنيع والتعديل.

إن استخدام الأدوات والمعدات اليدوية ، التي لا تتطلب أي طاقة كهربائية ، لتصنيع نظام قنوات الهواء يمنح المصنّع إمكانية تنفيذ وتصنيع مجرى الهواء مباشرة في الموقع. هذا يعطي مرونه ودقه أكثر ، في حالة الحاجة إلى بعض التعديلات.

Fabrication

Another great advantage of IM duct system its flexibility.

The use of hand tools and equipment, which do not require any electric power, for the fabrication of duct system gives the Fabricator the possibility to carry out the Fabrication of the duct directly at the site. This Gives More accurate job, thanks to the possibility of

immediately verifying the Conditions at the site. In case some modifications needed.

TECHNICAL CHARACTERISTICS

Dimensions of the panel 4000 x 1200 mm

Thickness of the panel 20 mm

Thickness of the external aluminum foil 60 microns embossed Thickness of the internal aluminum foil : 60 microns embossed Density of the foam 45 kg/m3

Weight of the panel : 1,40 kg/m²

Aluminum finishing : embossed / embossed

The external aluminum foil is lacquered with a weatherproof and ultraviolet rays protecting epoxy varnish.

INSULATING CHARACTERISTICS

Insulating material : Close cell rigid expanded pir foam, without CFC and HCFC. Material physiologically and chemically inert, insoluble.

Thermal Conductivity: 0,0216 W/mK

Foam density: 45 Kg/m3

The aluminum foils covering the panel assure a perfect vapor barrier.

TEMPERATURE OF USE

The air ducts fabricated with IM 60/60 panels can be used in installations with temperatures ranging from -35°C to +110°C, always operating. No relevant reduction of the insulating, chemical or physical characteristics of the panel will be observed.

PRESSURE OF USE

The air ducts fabricated with IM PIR 60/60 panels can be used in installations with pressures up to 1750 Pa, always in accordance with the construction stan-

dards fixed by IM.

HANDLING WARNING

During all handling processes, wear gloves.

SPECIFICATION OF USE

The air ducts fabricated by using IM panels can be installed in plants:

-with air speed up to 35 m/s

-with pressures up to 1750 Pa -indoor and/or outdoor

IM 60/60 panels are particularly fit for the construction of air ducts to be

installed in: -Hospitals

-Surgical Rooms

-Clean Rooms

-Pharmaceutical Industries

-Food industries

EXTERNAL USE

IM PIR PANEL 200/80

TECHNICAL CHARACTERISTICS

Dimensions of the panel : 4000 x 1200 mm

Thickness of the panel 30 mm

Thickness of the external aluminum foil :200 microns

embossed Thickness of the internal aluminum foil 60 microns

Density of the foam :45 kg/m3

Weight of the panel :2,20 kg/m²

aluminum finishing : imposed / imposed

The external aluminum foil is lacquered with weatherproof and ultraviolet rays protecting epoxy varnish.

INSULATING CHARACTERISTICS

Insulating material: Close cell rigid expanded pir foam, without CFC and HCFC

Thermal Conductivity: 0,0220 W/mK

Foam density: 45 Kg/m3

TEMPERATURE OF USE

The air ducts fabricated with IM panels can be used in installations with temperatures ranging from -35°C to +110°C, always operating. No relevant reduction of the insulating, chemical or physical characteristics of the panel will be observed.

IM PHENOLIC PANEL

TECHNICAL DATA SHETE

THICKNESS	20 MM -----200MM
LENIGTH X WEDITH	L 3995MMX W1200 MM
DEINSTY	(50-70) Kg/m^3
THERMAL CONDUCTIVITY	0.020 W/mK
FIRE RATING	CLASS 1 (UL 181)
	≤ 25
Flame spread index fir propagation index	CLASS 0
SURFACE SPRED INDEX	CLASS 1
DURATION OF FIRERISISTANCE	90 MINUITS
SMOKE DEVELOPMENTINDEX	≤ 45
Water vapor transmission	0.00 G/H M^2
HEAT RESISTANCE	-150~+150c°
WINED RESISTANCE	≤ 1500 KPA
COMMPRESSION STRINGITH	≥ 300 KPA
CLOSED CELL CONTENT	≥ 95%
LEACKG AIR VOLUM	≤ 1.2%
THERMAL RESISTANCE	1.064 M2 K/W
SMOKE DENISTY	NO TOXIC GAS RELEA
DIMINSION STABILITY	2% (70 ± 2c°,48 H)
OXYGEN INDEX	≥ 45
FORMALDHIDE EMISSION	≤ 0.5 M/L
AIR VILOSITY	15-30 M/S
STRESS AND DEFORMATION	QUALFID

TECHNICAL TESTS

Characteristic	Standard Result
- Panel Stiffness / Rigidity	EN 13403 353.000 N•mm
- Resistance to high pressure	EN 13403
- Resistance to positive/negative pressure	IM +3800 Pa / -4200 Pa No breakages or loss of functionality
- Air leakage (Positive/Negative Pressure)	EN 1507 Class "C" and "B"
- Air pressure drop inside ductwork	Negligible
- Resistance to high temperature	IM 110 °C
- Resistance to salty wither	No corrosion
- Sound reduction index	EN-ISO 140-3Rw = 16 dB
- Thermal Conductivity	IEEE STD 442 0,02475W/(m•K)
- Thermal Resistance	IEEE STD 442-1981
- Water absorption	ASTM D 2842-01 0.57
- Flammability (B.S)	BS 476, Part 6 & Part 7 Class 0
- Flammability (EU)	EU Class B
- Flammability (US Standards)	NFPA 101 / ASTM – E84 Class A

IM DUCT SYSTEM FABRICATION

The construction of a IM pre-insulated duct generally follows a standard procedure regardless of the shape of the duct as per SMACNA standards.

• Cutting • Gluing • Folding • Taping • Flanging and reinforcement if required • Sealing

Cutting

All measurements refer to a duct's internal dimension. This means the area of air passage or opening of the duct. All tracing and/or plotting is done on the internal side of the duct. Cutting 45° miter cuts are made along the edge of the

duct, while “V” cuts or grooves of the same angle are made for folding of the panel into shape. Other special purpose angles can be made including 22.5°.

Gluing

The glue is contact adhesive and can be applied evenly to the cut surfaces with a glue spreader or a simple all-purpose paint brush. The “V” grooves must be cleaned off of any PIR foam particles or dust.

Generally the curing period of the adhesive is between 10 to 20 minutes or when the glue is dry to the touch.

Folding

After the glue is cured, the sides are folded to each other and the duct is formed. When the outer sides of the duct are joined, use the internal surface of the cuts for aligning purposes. The rigid spatulas used to crease well the edges of the duct in the glued grooves.

Taping

The special double cured reinforcement aluminum tape is is applied for the purpose of: sealing PIR foam material from the area, as a vapor barrier in the folded seams of the duct, to repair or cover any damages to the panel and for aesthetic appearance of the duct.

Before applying the tape, be sure that the surfaces are dry and clean.

Ideally the tape should be applied at temperatures above 10° C, it should not be applied when temperatures are below 0°C. The tape is applied only to the external seams of the duct where the sides of the panel were joined, and not on the folded “V” groves. tape. A soft spatula is used to brush along the surface of the tape and eliminate trapped air bubbles.

Flanging and Reinforcement

IM offers two types of flanging systems for joining ducts together

1. Invisible Flange with hidden “H” bayonet in PVC The invisible flange is convenient in limited access areas and where the ducts are mounted in sight and aesthetics is a priority.

2. Teeth Connector

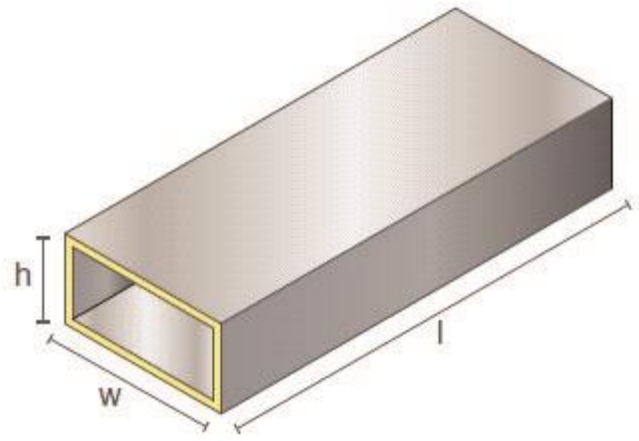
The “teeth connector” is designed for use with small ductwork and low air pressure systems.

Duct reinforcement is required to protect against negative and positive pressure of systems based on two parameters: Duct size and total system pressure.

Sealing

After the duct has been assembled, all internal joints must be hermetically sealed with silicon. Apply a bead of silicon to all the joints and then using a radiuses tool or a wet finger run it along the length of the silicone to spread the sealant along the side of duct wall. Besides sealing the joints, the silicon also prevents any foam particles from entering the flow of air.

RECTANGULAR DUCTS



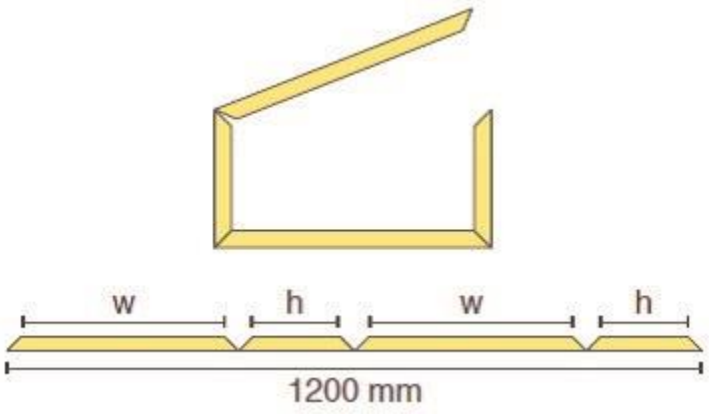
Method :

The duct panels may be cut in either width or length direction taking in consideration the duct’s dimensions and the material usage. In order to optimize the duct’s mechanical characteristics and fully utilize the panel (minimal waste), four different cutting methods may be employed, each with its own limiting dimension.

Method 1

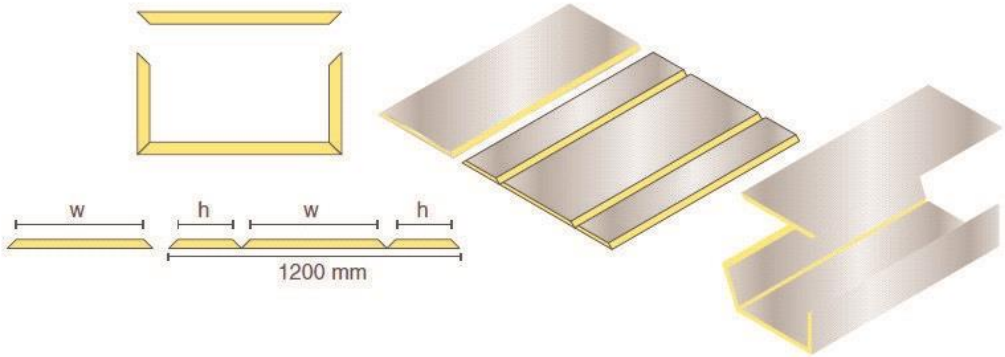
In this method the entire duct can be fabricated using a single panel based on the duct side dimensions Listed on table:

Considering the off-cuts of the grooves: 20+40+40+40+20 = 160mm subtracted from the panel width of 1200 mm = 1040 mm The cuts are made in the lengthwise direction and the duct is fabricated as shown below:



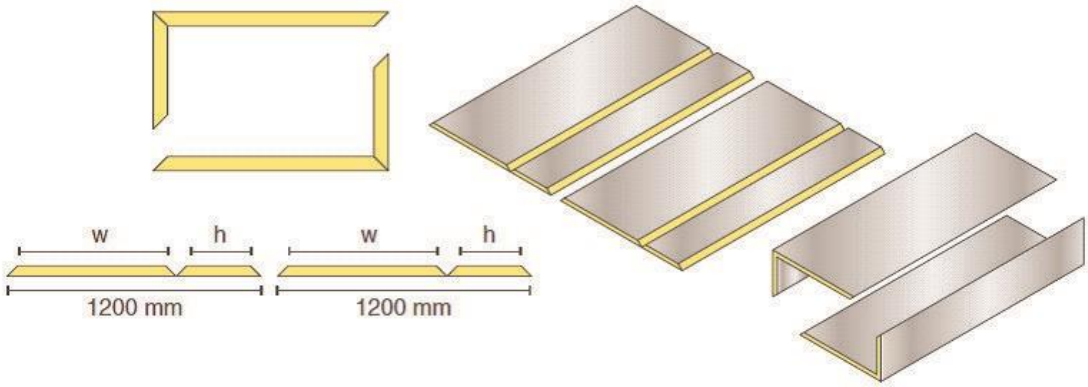
Method 2

This method is for larger ducts and constructed using more than one panel that are joined together to Form the duct. The dimensions of the duct determines if the joining pieces are of equal or unequal size as shown in method 3 and 4. This method is used, when the sum of three sides is less than or equal to 1,080 as shown on the table and cannot be constructed using only one panel as in method 1.The grooves are again cut in the lengthwise direction.



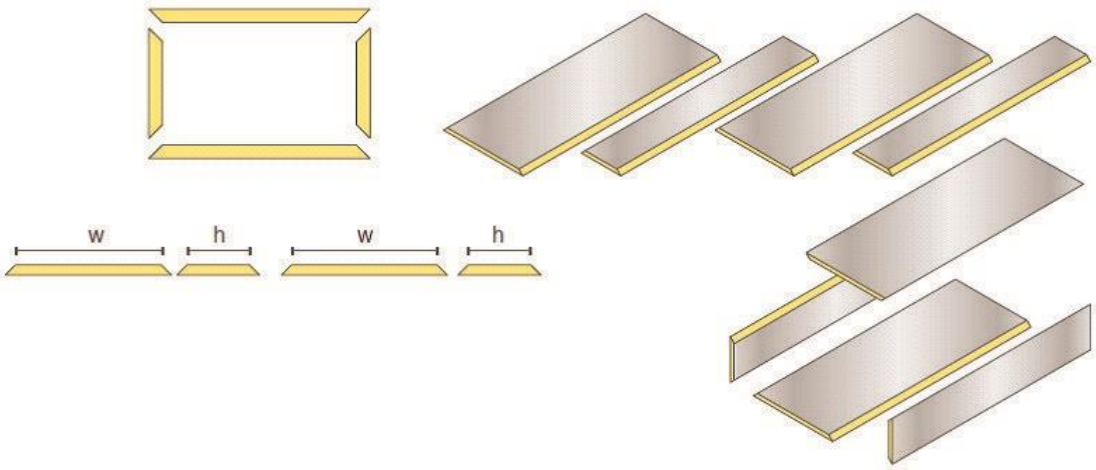
Method 3

If the duct is larger than method 2a and the sum of two sides is less or equal to 1120 mm as shown on the table, method 2b is used. The grooves are again cut in the lengthwise direction.



Method 4

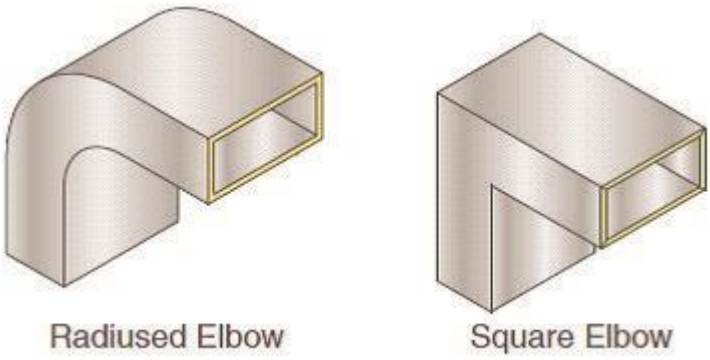
If the duct is yet larger than method 3, the dimensions would be limited to the width of the panel: 1200mm minus the 45° cuts on each side. 1200mm-40mm=1160mm. The cuts are again made in the lengthwise direction and the duct length is limited by the length of the panel: 4000mm.



ELBOWS AND SPECIAL FITTINGS

Among the many fittings in a duct system, elbows are perhaps the most common.

Below are a few types Of elbows



Radiuses Elbow Square Elbow

A Radiuses Elbow is one in which the air flows smoothly along the radiuses path with **minimal noise or drag. In a Square Elbow the air is abruptly deviated which causes more drag and noise, this is the reason why in this type of elbow the use of turning vanes is required.**

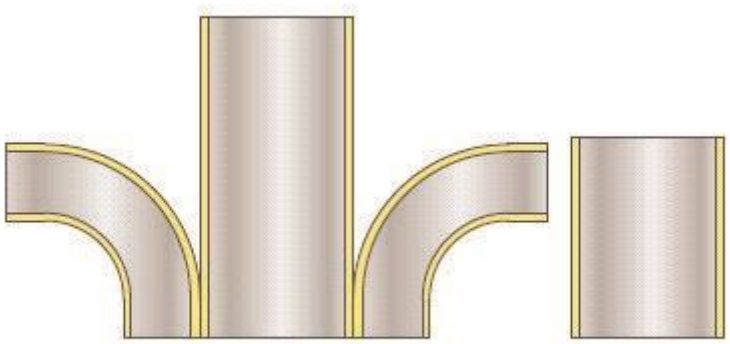
Elbow Construction

Construction of an elbow begins with cutting of four separate pieces from a PIR panel based on the inlet and outlet dimensions, neck lengths and radius requirements. The minimum length of any neck and internal radius shall be 200mm. The distance between the creases on the inner and outlet strips shall not be less

than 50mm. All the cuts are made using the appropriate cuter (45°, 90° etc..) The four pieces are the inner, outer and sides pieces as shown below:

Elbow Components

All measurements should be made on the internal side of the duct. When measuring the inlet and outlet strips, an nominal amount should be added to compensate for the bending creases that will be made on the strips later. Use a bending machine to crease the inlet/outlet strips. Note that the bending creases on the inner strip are made on the external surface and on the internal surface for the outer strip.

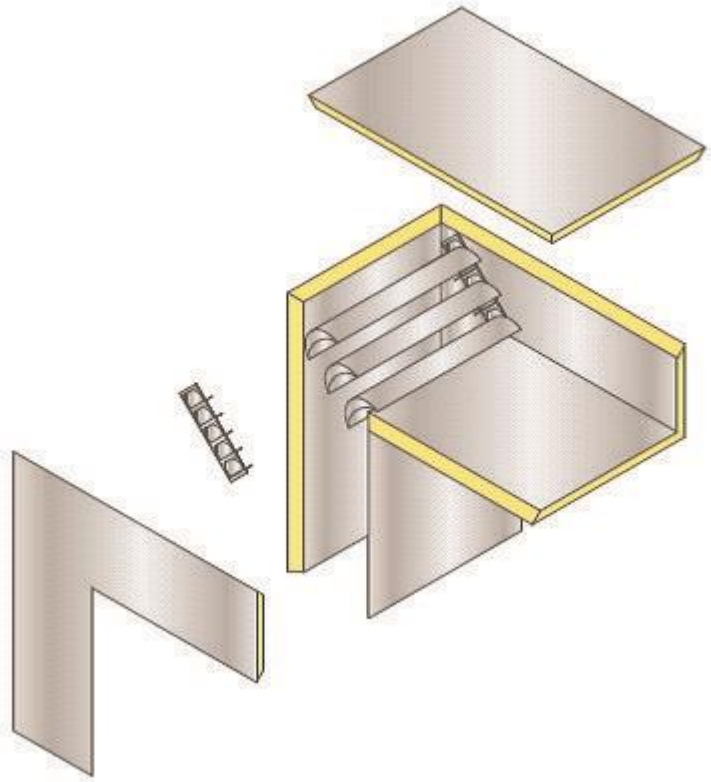


Elbow Components

1. After having followed the fabrication procedure including the gluing process, lay the outer strip onto the table and starting at the end of the neck of each side strip properly align and join both pieces to the outer strip. Continue along The outer radius until all three pieces are glued together.
2. The inner strip is glued onto the inner side of the elbow using the same alignment procedure as previously.

Turning Vanes

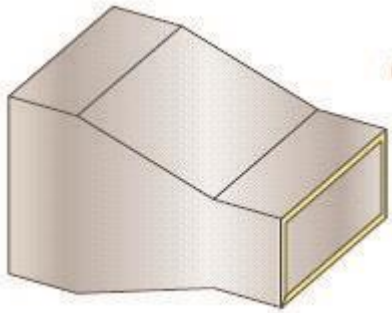
When there is lack of space and/or the design specifies it, the use of square elbows is employed. In this case, all square elbows shall have “turning vanes “installed inside them. The turning vanes are aerodynamically designed to assist the airflow and limit the amount of noise and drag. Normally the turning vanes are fastened to an aluminum strip mounted externally to the elbow.



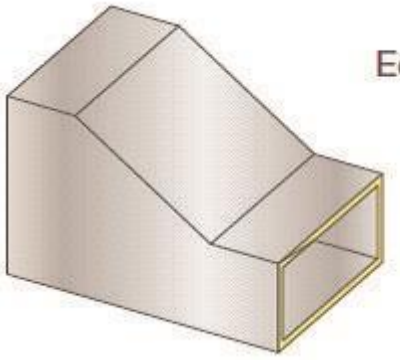
Square Elbow and Turning Vanes

REDUCERS

Reducers may have a taper on one side of the duct only, this is classified as an “eccentric” reducer, while one with tapers on both sides is classified as “concentric”.



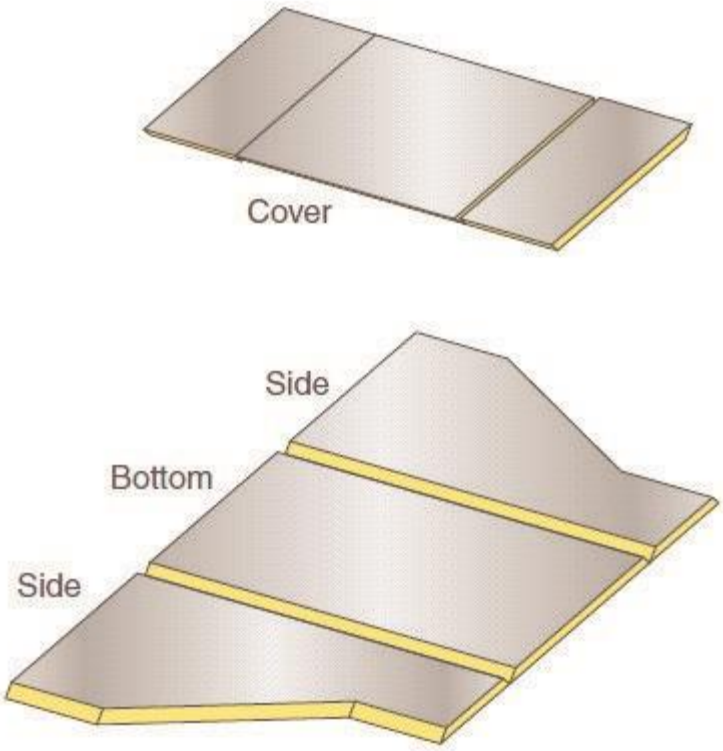
Concentric Reducer



Eccentric Reducer

Reducer Construction

Construction of a reducer begins with cutting of four separate pieces from a PIR panel based on the inlet and outlet dimensions, and a minimum neck length of 200mm before and after the taper. The taper angle shall not exceed 20°. The four pieces are the two sides, the bottom side and the cover as shown:



Components of a Reducer

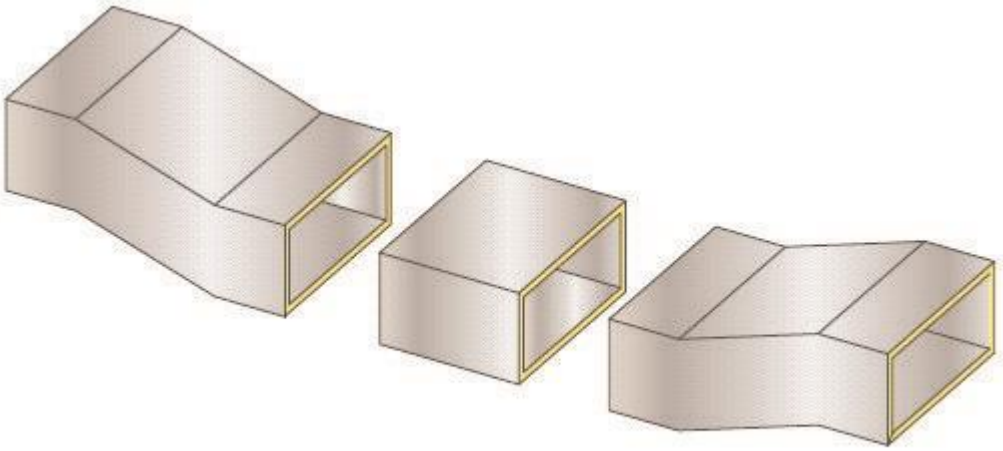
Reducer assembling

The assembly begins with the connecting the side pieces to the bottom piece followed by the creased cover.

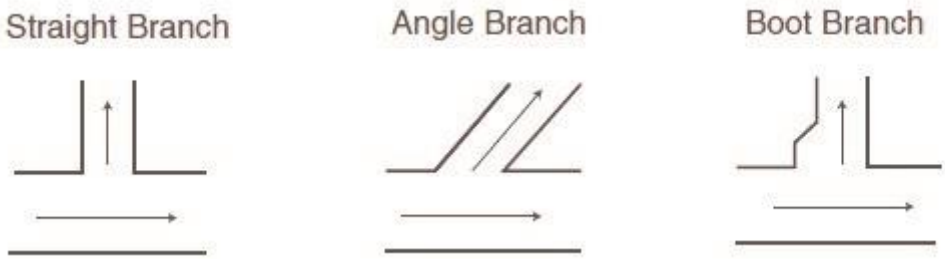
The cover shall have a minimum of 3 creases per bend made with a bending machine.

Offsets

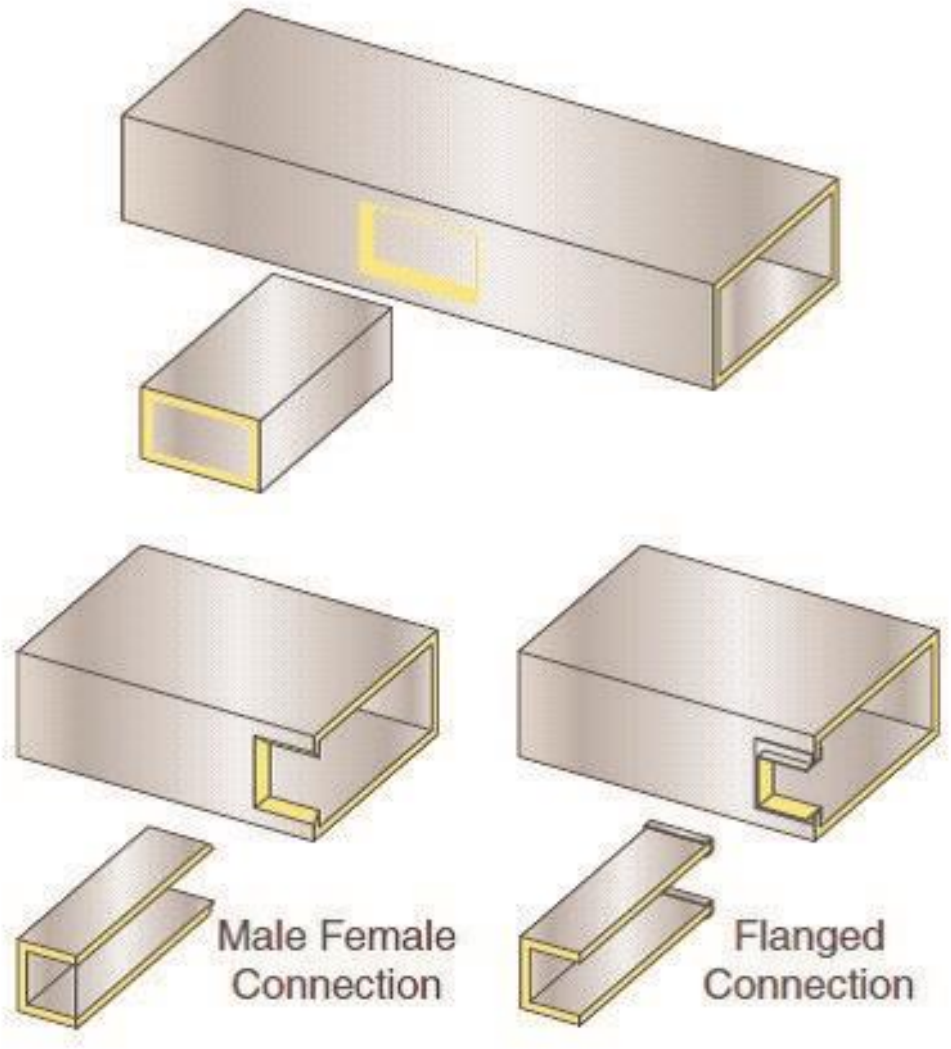
Offsets are often used to deviate around an obstacle or connect to a differently aligned duct. Various angles can be used for cutting of the V grooves and other cuts. Again like elbows and reducers, offsets are constructed beginning with the cutting of four separate pieces from a PIR panel based on the inlet and outlet dimensions .Neck size is the same as in a reducer: minimum of 200mm and the angle no greater than 30 degrees. The four pieces are then glued together, taped and sealed .Static take-off branches are typically made in Straight Branch, Angle Branch and Boot Branch.



Application of Offsets



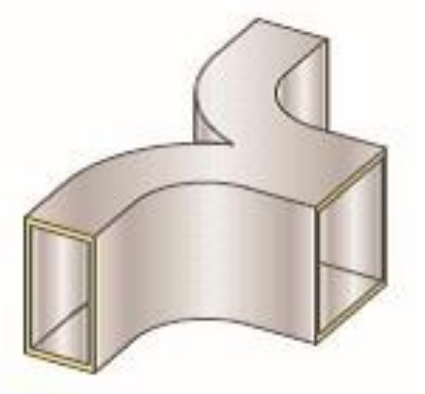
TAKE-OFFS



Static take-offs attachment to main duct

Dynamic Branch and Tee

Dynamic Branches Dynamic branches are used to direct the air stream velocity pressure to the branches. The general norms apply to dynamic branches: the neck length must be at least 200mm, the internal radius is minimum 200mm, and creases on curved strips must be at least 50mm apart.



Construction of Dynamic Branch and Tee

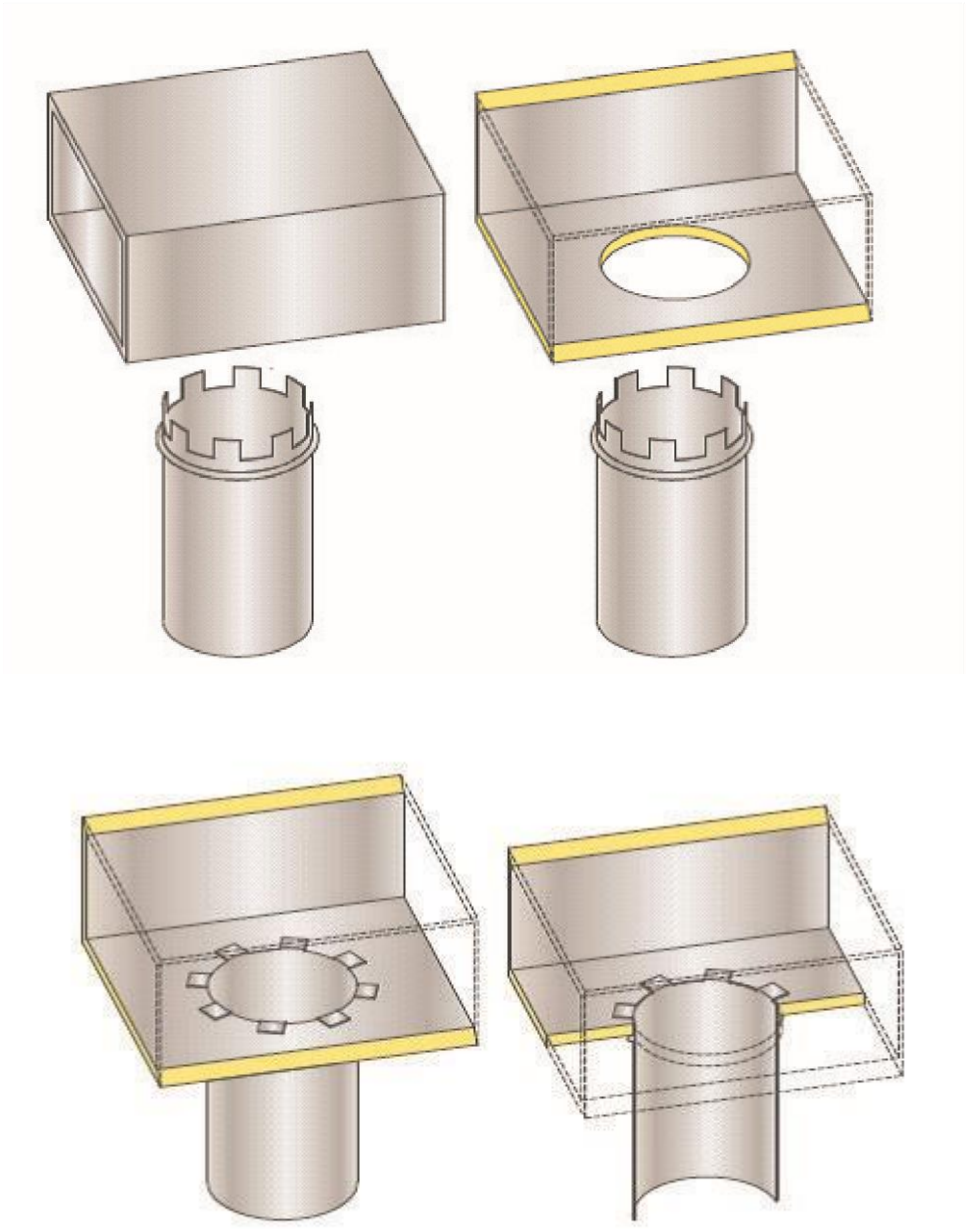
The same procedure and steps used for fabrication of elbows and reducers is used for dynamic branches, though they are perhaps the most complex pieces to construct. Assembly of two-way dynamic branch begins with the left and right sides attached to

the base piece, followed by the assembly of the taper strip, outer strip and finally the **inner strip .The sequence for assembling the two-way tee begins with attaching the both creased inner strips to one of the side tees, followed by the attachment of the other side piece to the two inner strips. Then attach both outer creased strips to both of the sides to complete the tee.**

Connection to aluminum spiral fittings

A circular hole equal to the diameter of the fitting is made on the duct using the round hole cutter tool, or by first scribing the perimeter circle around the fitting and then cutting the hole with a standard utility knife. The fitting then is inserted in the hole and **the tabs then bent back against the inner surface of the panel. Silicon shall be applied**

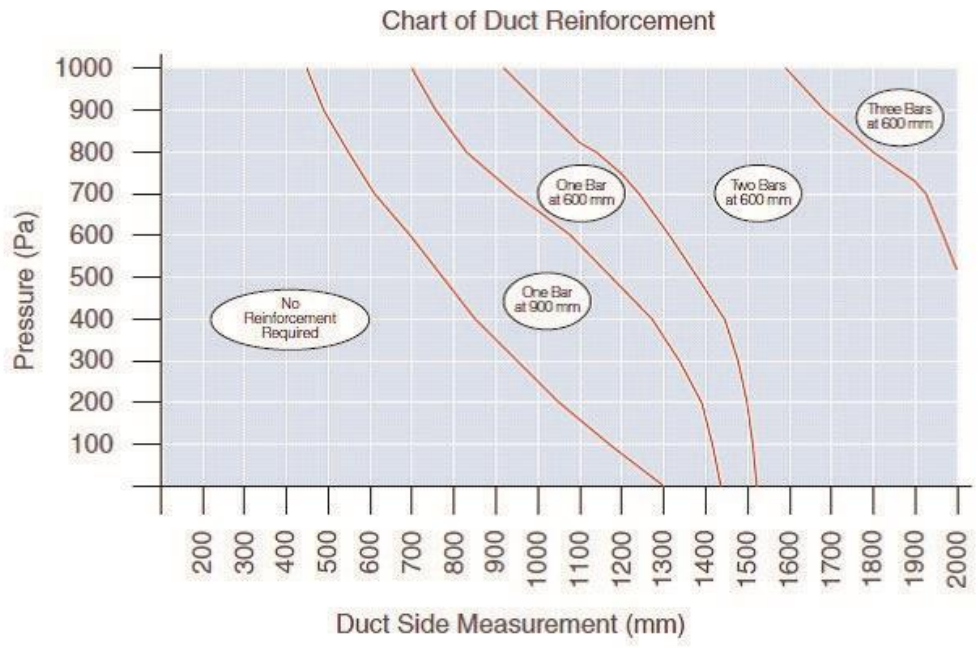
around the groove between the fitting and supply duct's outer surface. Pieces that make up a dynamic branch Installation of spiral fitting



Installation of spiral fitting

DUCT REINFORCEMENT

Duct reinforcement is required against deformation due to negative and positive pressure or both. Careful observation of the reinforcement details in this section and proper application is a must. Duct Reinforcement application whether reinforcement is required or not is determined by two Parameters:



Duct size, and Total System Pressure (A/C system

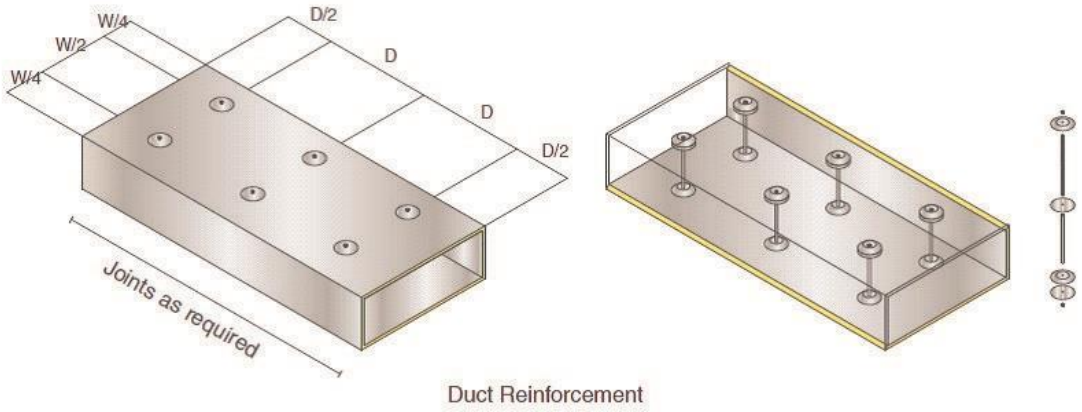
static pressure).

Duct Side Measurement (mm)

Pressure (Pa)

Installation of Duct Reinforcement

Duct reinforcement is required against deformation due to negative and positive pressure or both. Careful observation of the reinforcement details in this section and proper application is a must. Duct Reinforcement application whether reinforcement is required or not is determined by two Parameters:



Duct Reinforcement

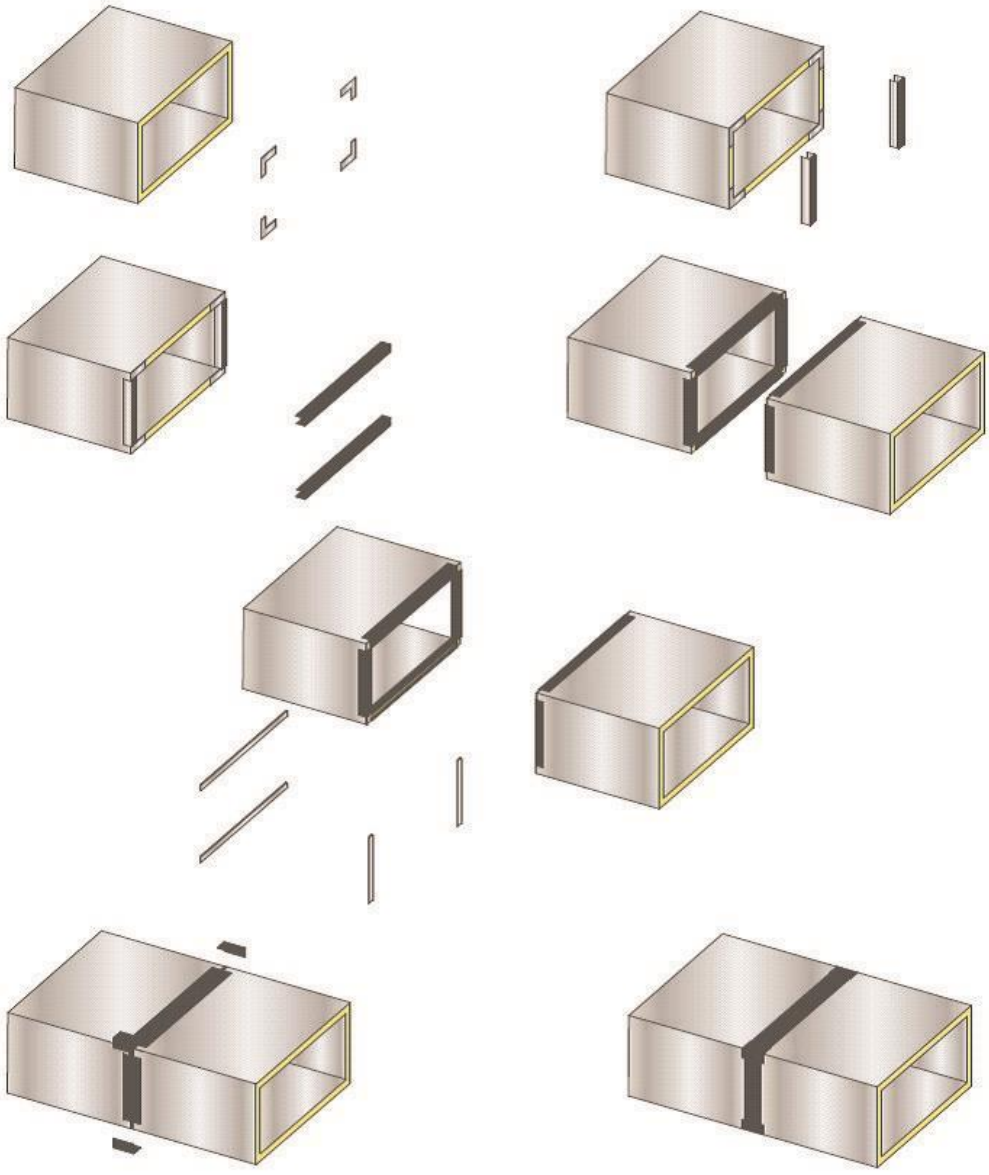
Duct Reinforcement Joints as required

In case of multiple reinforcement bars as shown above, the distance between bars is 50% of the step Distance as indicated on the reinforcement chart. When an horizontal bar is also required, the bars shall be tied together at the point of intersection with cable ties.

Aluminum Flanges

IM suggests two different types of flanging systems for joining duct segments together.

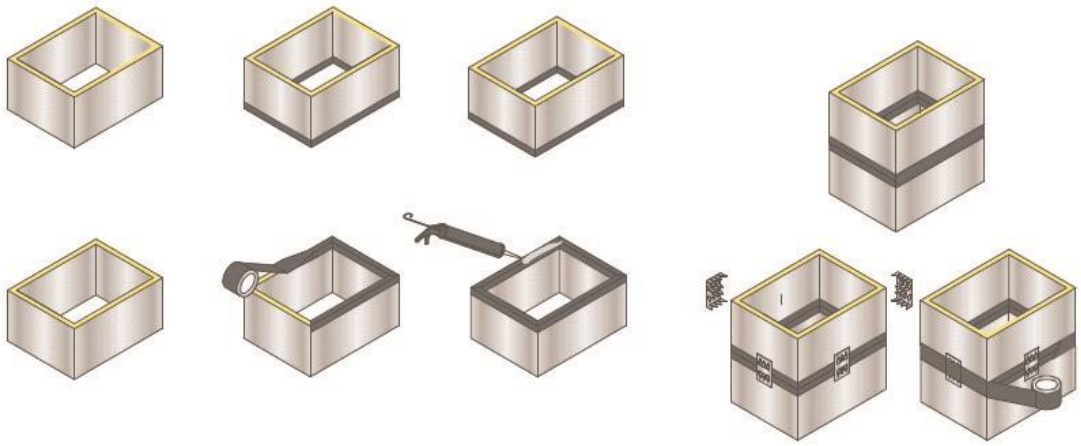
- **Invisible Flange**



Determination of the type used is based on the application. The one generally used is the invisible flange, where the "H" shaped bayonet in PVC joining the two segments together is hidden (invisible) inside the two aluminum profiles. Two of the main features of the invisible flange is the easy installation in limited access areas and when the duct is **in-view and aesthetics are a prime consideration. It provides a tight joint without the use of adhesive or gasket. The Teeth Connector is a very economical alternative only in small** and low pressure ductwork applications. Small is defined as maximum size of any duct

side to 500mm and maximum pressure of 500 Pascal. It is an aluminum plate with prone points (teeth) in each end.

Teeth Connector Flange



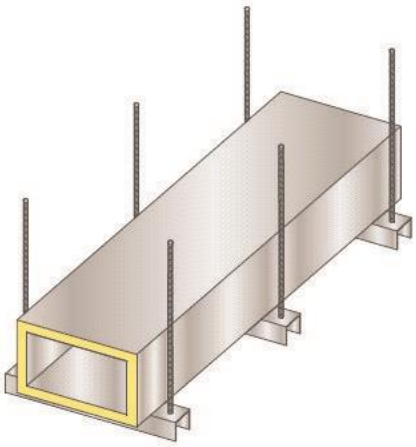
Aluminum tape is applied to the ends of the two duct segments followed by a continuous bead of Silicone around the end of only one segment. Then, the two duct segments are joined together and a Tooth Connector for duct sides up to 300mm is pressed in the middle of all four sides of the duct and centered over the seams. For ducts between 300 and 500mm, two Teeth Connectors evenly spaced are applied. Aluminum tape is then wrapped around the joint of the two ducts which consequently covers the Teeth Connectors and the seams.

DUCT SUPPORT AND HANGERS

Duct made of im PIR panels is a very light weight system, and therefore the support and hanging system does not have to be as strong as a sheet metal system. Attachment of the ductwork to the building frame may be made of beam clamps, spring clips, wall clamps and screw anchors. Installation of duct support and hangers

The most common types of duct support system are steel channel combined with a threaded bar or hanger strap. The duct support bars shall be at least 50mm in width and 22 gauge minimum thickness.

DUCT SUPPORT AND HANGERS



Hangers and Support

IM DUCT

CONSTRUCTION

STANDARDS ACCORDING SMACNA

EDITION -- 2024

REFERENCES

The editions of the following should be used as reference material when working with the information contained in this Standard

ASTM C 518–10: Standard Test Method for Steady–State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM E 84–14 Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96 / E96M-13 Standard Test Methods for Water Vapor Transmission of Materials

NFPA 90A 2015 Edition Standard for the Installation of Air-Conditioning and Ventilating Systems

NFPA 90B 2015 Edition Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012

SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005

SMACNA Fire, Smoke And Radiation Damper Installation Guide For HVAC Systems, 5th Edition, 2002

SMACNA Seismic Restraint Manual Guidelines For Mechanical Systems, 3rd Edition, 2008

UL 181 (Ed. 11) Standards for Factory-Made Air Ducts and Air Connectors

UL 181A (Ed. 4) Standard for Closure Systems for Use with Rigid Air Ducts

UL 723 (Ed. 10) Standard Test Method for Surface Burning Characteristics of Building Materials

CHAPTER 1

MODEL PROJECT SPECIFICATIONS

1.1 DUCT CONSTRUCTION

IM pir and Phenolic duct shall conform to the SMACNA Phenolic Duct Construction Standards, 1st Edition, 2015 (herein referred to as the PDCS).

Im pir and Phenolic duct shall be a Class 1 Air Duct Listed and Labeled in accordance with saso and Underwriters Laboratories UL) and have an available Certificate of Compliance to UL 181 Standard for Safety for
The thermal conductivity and R-value of Phenolic Duct panels shall be tested in accordance with ASTM C518

The fabricator shall submit for the approval of owner's representative or the approval of local mechanical code official the following:

A. The title of the standard the fabricator chooses to comply with;

B. A list of any deviations from the selected standard and the reason(s) therefore;

C. The name and product rating of manufacturer of the phenolic panels;

D. The type of closures systems selected along with confirmation that they are acceptable to the phenolic panel manufacturer and are UL listed;

E. A schedule of duct pressure classifications and the air handling systems for which they are selected;

F. The type and spacing interval of supports selected;

2. GALVANIZED STEEL SHEET

For hangers, supports and accessories, zinc coating weight for all galvanized steel sheet shall be G60 (Z180) or for exterior applications, G90 (Z275).

3. DUCT DIMENSIONS

Duct dimensions shown in the contract drawings are for airflow area, which are interior dimensions.

4. DUCT PRESSURE CLASS

Duct pressure classes are to be identified on the contract drawings.

**Schedule the pressure classes here by fan system number, or portion thereof, if they are not shown on the drawings.*

5. DUCT SEAL CLASS

Ducts constructed in accordance with the PDCS shall be compliant with Seal Class A as defined in SMACNA *HVAC Duct Construction Standards, Metal and Flexible* (hereinafter referred to as the "*HVAC DCS*").

6. DUCT LEAKAGE CLASS

Phenolic duct may follow SMACNA Leakage Class 3. For duct leakage testing purposes, the duct interior dimensions shall be used for duct surface area calculations. Reference sections 2.2 and 2.3 in the PDCS.

**Consult the ANSI/SMACNA HVAC Air Duct Leakage Test Manual.*

**For duct leakage testing, the test pressure shall not exceed the duct construction pressure class. The designer must specify duct system pressure relief procedures and precautions to protect and prevent duct systems from over pressurization.*

1.7 FLEXIBLE DUCT AND CONNECTOR

Flexible duct and connector shall be in conformance with the HVAC DCS. Where the specifications for connecting and supporting these in the PDCS are more stringent or restrictive, they shall supersede.

1.8 VIBRATION ISOLATION CONNECTORS

Flexible isolation connectors shall not exceed 10 in. in length in direction of airflow and shall be made of flame-retardant fabric having a flame spread rating not over 25 and a smoke developed rating not over 50. Flexible isolation connectors to be tested in accordance with Underwriters Laboratories (UL) Standard 181 and must be installed in accordance with the conditions of their UL listing.

**Consult the applicable codes, The UL Fire Resistance Directory, references in the HVAC DCS, the Air Diffusion Council's Flexible Air Duct Performance and Installation Standards and identify the products and performance characteristics desired.*

9. PROPRIETARY PRODUCTS

Description of products from a proprietary or single source manufacturer shall be submitted for approval along with substantiation of fitness for the service conditions that are proposed but not already identified in the project specifications.

10. PENETRATIONS

All wall penetrations that require special-purpose dampers (fire, smoke, etc.) shall be shown in the contract drawings.

**Consult the SMACNA Fire, Smoke, and Radiation Damper Guide and local codes for obligations to show the location of each barrier penetration protection device on contract drawing. Designer must show all air volume control devices on the contract drawings when they are not specified to be integral with HVAC units or air terminal units. Also specify the size and location of all access doors and access panels to be used in ductwork.*

*NOTES FOR THE SPECIFIER

CHAPTER 2

DUCT PERFORMANCE CHARACTERISTICS

2.1 PHENOLIC DUCT PERFORMANCE CHARACTERISTICS

A. **Maximum static pressure in duct**. 4" w.g. (1000 Pa), positive; 3" w.g. (750 Pa) negative.

B. **Maximum air velocity in duct**. 5,000 ft./min (25.4 m/sec)

C. **Maximum allowable stress in steel members used for reinforcement or support**. 22,000 lb./in.^{2} (152 MPa) with 30,000 lb./in.^{2} (207 MPa) yield strength minimum.

D. **Vapor transmission.** The vapor retarder of the phenolic panel shall have a maximum permeance of 0.05 perm [2.87 ng/(Pa • s • m^2)] in accordance to ASTM E 96 or shall be an aluminum foil having a minimum thickness of 2 mils (0.051 mm).

E. **Temperature**. –15°F (–26°C) minimum inside duct. 185°F (85°C) maximum inside the duct, continuous operation.

F. **Corrosiveness**. Non-corrosiveness in contact with galvanized steel, aluminum or stainless steel.

G. **Closure**. Closure systems shall conform to Underwriters Laboratories Standard UL 181A installed in accordance with the manufacturer's Class 1 Air Duct listing.

H. **Safety Standards**. NFPA Standard 90A, 90B and UL 181.

I. **Phenolic Panels.** The thermal conductivity and R-value of Phenolic panels shall be tested in accordance with ASTM C 518

J. **Reinforcement testing.** Test programs have demonstrated that phenolic duct systems, including fittings such as offsets, tees, elbows, branches, transitions, and accessory items are capable of maintaining their structural integrity at 1.5 times systems design pressurization. While this testing demonstrates the reliability of properly constructed systems, it does not imply that systems should be operated at pressures above their reinforcement rating.

K. **Restrictions**. Phenolic duct systems shall not be used in the following applications:

1. Kitchen/grease exhaust, fume exhaust, smoke exhaust or to convey solids or corrosive gases.
2. Installation in concrete or buried below grade.
3. Outdoors without mechanical or weather protection.
4. As casings or housings of built-up equipment.
5. Immediately adjacent to high temperature electric heating coils without radiation protection. Refer to NFPA Standard 90A.
6. Adjacent to any mechanical or electrical sources of extreme heat.
7. With equipment of any type which does not include automatic maximum temperature controls or where failure of automatic control equipment may give rise to extreme temperatures.
8. With coal- or wood-fueled equipment.
9. Where products of combustion readily collects inside the ductwork.
10. Where normal operating pressure or occasional over pressure would exceed the phenolic duct rating.
11. As penetrations in construction where fire dampers are required.
12. Where moisture would collect in the duct.
13. Where condensation would occur on the duct exterior.
    a) Exception: Ductwork is not prohibited in indoor locations where condensation can occur provided all duct system components exposed to the condition are of non-corrosive construction. Where corrosion is a problem for electro-galvanized or hot-dipped galvanized materials, materials of aluminum or stainless steel construction shall be utilized.

Such components include but are not limited to: fasteners, transverse joint flanges, reinforcement components, tie rod external components, accessories, miscellaneous hardware, etc.

L. **Mounting of accessories**. When mounting equipment, dampers, damper operators, control motors, etc., the duct system must be adequately reinforced and supported to accommodate the additional weight of the material and equipment without damage to the duct material. Particularly important is the mounting of both dampers and their operators on the same sleeve or mounting plate.

M. **Beam Strength of Duct Section**. A duct section between adjacent hangers must be able to carry its own weight and to resist external loads for which it is constructed. The phenolic panels, joints and support systems listed in the PDCS construction tables are not qualified for supplemental loads. Specifically, the joints and phenolic panels listed in the current construction tables are not designed to support the weight of a person.

N. **Class 1 Air Duct Rating**. When ducts must conform to NFPA Standard 90A and model codes, phenolic ducts are required to conform to the following requirements:

1. They shall be constructed of Class 1 duct materials as tested in accordance with Underwriters' Laboratories Standard for Factory Made Air Ducts and Air Duct Connectors, UL 181.

2. Such ducts shall be installed in accordance with conditions of their listing.

3. They shall not be used in air duct systems which operate continuously with an air temperature higher than 185°F (85°C) entering the ducts.

4. They may be directly attached to listed heating and cooling equipment designed to operate at temperatures not exceeding 185°F (85°C.). Under UL Standard 181 Class 1 air duct materials have flame spread rating not exceeding 25 without evidence of continued progressive combustion and a smoke developed rating not exceeding 50. Furthermore, the following portions of UL 181 are applicable to rigid phenolic ducts in new material conditions:

   a. Surface burning characteristics

   b. Flame penetration

   c. Burning

   d. Mold growth and humidity

   e. Temperature

   f. Puncture

   g. Static load

   h. Impact

   i. Erosion

   j. Pressure collapse

   k. Leakage

O. **Pressure sensitive tapes**. Pressure sensitive tapes that pass UL Standard 181A tests are imprinted with the manufacturer's name (or symbol), date of manufacture, product code and the wording "UL Listed 181A-P".

P. **Sealer and Adhesive**. Phenolic panel manufacturer approved sealant/caulk (hereinafter referred to as "sealer") and adhesive shall be suitable for phenolic duct construction.

2.2 DUCT SEALING

Ducts constructed in accordance with the PDCS shall be compliant with Seal Class A as defined in the *HVAC DCS.*

**For phenolic duct construction, five pressure classes exist [½ in. (125 Pa), 1 in. (250 Pa), 2 in. (500 Pa), 3 in. (750 Pa), 4 in. (1000 Pa)]. If the designer does not designate pressure class for duct construction on the contract drawings, the basis of compliance with the SMACNA Phenolic Duct Construction Standards is as follows: 2 in. wg (500 Pa) for all ducts between the supply fan and variable volume control boxes and 1 in. wg (250 Pa) for all other ducts of any application.*

**Some sealers can adversely affect the release function of breakaway connections to fire dampers; consult the damper manufacturer for installation restrictions.*

2.3 LEAKAGE TESTS

Refer to ANSI/SMACNA HVAC Air Duct Leakage Test Manual for leakage test procedures.

**For duct leakage testing, the designer must specify duct system pressure relief procedures and precautions to protect and prevent duct systems from over pressurization.*

2.4 OTHER PERFORMANCE CHARACTERISTICS

Consult design handbooks and phenolic panel manufacturers for friction loss coefficients and thermal and acoustical performance.

2.5 COMMENTARY

- Vertical ducts serving more than two adjacent stories in height shall be adequately supported consistent with good engineering practices. See *HVAC DCS* for means and methods.

- SMACNA recognizes that research continues and that future advances will lead to phenolic panels which are thicker and have higher thermal resistance than contained in the PDCS.

*NOTES FOR THE SPECIFIER

3.1 GENERAL SPECIFICATION REQUIREMENTS

A. All ducts required to meet Class 1 Air Duct rating shall comply with Underwriters Laboratories (UL) Standard 181. All closure systems shall meet UL 181 or UL 181A-P. Aluminum pressure sensitive tapes (hereinafter referred to as "tape"), shall be imprinted with the coding 181A-P, the manufacturer's name and a date code. Sealer and adhesive shall be suitable for phenolic duct construction and be compliant with the listed phenolic duct listings by Underwriters Laboratories.

B. All phenolic duct shall be constructed so that the duct wall deflection does not exceed 1 percent of the span when pressurized at or below the rated pressure classification.

C. Construction detail(s) not otherwise required conforming to a condition of listing or a superimposed requirement in these standards shall conform to the recommendations of the phenolic panel manufacturer.

D. Sheet metal items shall be fabricated as specified in the *HVAC DCS* except as necessarily altered for incorporation in phenolic duct. Metal items shall be installed in a manner that does not cut or damage the phenolic panel surface. Metal sleeves and collars of undesignated thickness shall be of duct wall gage prescribed in the *HVAC DCS*.

E. All fastenings not otherwise identified shall be:

1. Screws to be corrosion resistant minimum #10 sheet metal screws.

2. Washers to be corrosion resistant reinforced and 3.5 in. (90 mm) minimum diameter and .04 in. (1 mm) minimum thickness (herein referred to as "reinforced washers").

3. Rivets to be corrosion resistant blind rivets with aluminum body. Minimum diameter 5/32 in. (4 mm).

F. All screws and rivets penetrating phenolic panel shall be no more than 0.5 in. (13 mm) longer than panel thickness. Washers shallbe 3.5 in. (90mm) diameter minimum and .04 in. (1mm) thickness minimum and be used under screw heads or rivet heads wherever the head does not rest on channel, sleeve or other metal bearings and shall be used as retainers on duct interiors wherever metal sleeves, equipment flanges, vane rails, or other suitable retainers are not present.

G. All fastenings, reinforcements and attachments shall be non-corrosive.

H. All horizontal branches and run-outs to air terminals shall be supported independent of the main duct.

I. Main duct to branch duct extractor installations, if required by the designer's contract drawings, shall not be installed without metal sleeves on the duct interior.

J. Metal dovetail tabs shall be bent tightly onto duct interior surface and shall not be less than 0.75 in. (19 mm) length on duct interiors. Exposed phenolic insulation foam remaining after bending the metal dovetail tabs onto the phenolic duct interior surface to be covered with tape or sealed. Reference Figure 4-17.

K. Rectangular non-flanged connection fittings to mains and submains require sealer applied around the exterior perimeter of the joint. Reference Figure 4-15.

L. Provision shall be made for locking dampers in position after flow adjustment.

M. Damper fabrication and installation to be in conformance with *HVAC DCS* except as altered for incorporation in phenolic duct as noted in the PDCS. Reference Figures 7-1, 7-3 – 7-6.

N. Except for transfer ducts, all 90° square throats and square heel elbows with a duct dimension more than 8 in. (200 mm) shall be vaned. Reference Figure 4-20.

O. Splitter vane fabrication and installation shall conform to the requirements of the project plans and specifications. Reference Figures 4-4 – 4-6, 4-8 and 4-10.

P. The fabrication of various fittings requires that creases be provided. To protect the phenolic panels from damage, crease angle limits are as follows: 7/8 in. (22 mm) panels are limited to

45 degree angle creases; 1 3/16 in. (30 mm) panels are limited to 30 degrees angles creases.

Q. Metal turning vane and track assemblies shall be fabricated in accordance with PDCS. Metal turning vane and track assembly to be non-corrosive. For ducts with a greatest duct dimension to 24 in. (610 mm) or less and a duct pressure class of 2 in. w.g. (500 Pa) or less, turning vane tracks are permitted to be affixed to the duct interior with sealer. For ducts with a greatest duct dimension over 24 in. (610 mm) or a pressure class over 2 in. w.g (500 Pa), vane runners require additional mechanical fastening. Reference Figure 4-20.

R. Metal access doors shall conform to the PDCS construction detail(s). Phenolic duct opening perimeter is required to be fitted with a phenolic duct flange to accept the access door or access door frame. Access doors and matching frames require the application of sealer as indicated in the PDCS. Reference Figure 7-2.

S. Access doors shall be located at least 4 in. (100 mm) from the end of duct joints and connections.

T. Ducts shall be made as indicated in the PDCS. They shall be secured and reinforced as specified.

U. All tape shall be 3 in. (76 mm) minimum width.

1. Exception: At four bolt flanges, 2 in. (51 mm) wide tape is permitted. The purpose is to protect the phenolic panel while affixing the four bolt flange. Reference Figure 3-9.

V. All tape shall be applied in accordance with the recommendations of the tape manufacturer including but not limited to compliance to tape manufacturer's recommended application temperature range.

W. Sealer shall be suitable for phenolic duct construction and be compliant with the phenolic duct listings by Underwriters Laboratories (UL) Standard 723. Sealer application shall be in compliance to the sealer manufacturer's recommended application temperature range.

X. When the application of sealer is required by the PDCS, the sealer bead shall be minimum 5/32 in. (4 mm).

Y. Adhesive shall be suitable for phenolic duct construction and be compliant with the phenolic duct listings by Underwriters Laboratory. Adhesive application shall be in compliance to the adhesive manufacturer recommended application temperature range.

Z. Gaskets shall be suitable for phenolic duct construction.

1. For the "A", "B", "C" and "D" type flanges, gasket shall be compressible polyurethane foam, minimum thickness 5/8" (15 mm) × 5/8" (15 mm) wide.

2. For the 4-bolt flange and at other gasket applications not indicated in 3.1.Z.1, gasket shall be compressible polyurethane foam, minimum thickness 5/8" (15 mm) × 5/8" (15 mm) wide or durable materials such as soft elastomer butyl or extruded forms suitable for flanged joints/connections.

AA. Tape utilized at longitudinal seams shall be adhered to at least an approximate 1.5 in. (38 mm) wide strip of each contact surface being closed. Tapes at other closures shall be as indicated in the PDCS. The application of UL tape over phenolic duct cleated panel fasteners (herein referred to as "panel fasteners" and "panel fasteners type 2") shall not result in the panel fasteners puncturing the tape.

BB. Panel fasteners spacing shall be in conformance with the PDCS.

CC. The depth and thickness of grooving shall be appropriate for the specific phenolic panel thickness of 7/8 in. (22 mm) or 1 3/16 in. (30 mm)

DD. At shoe branch type connections, the cut opening at the main or submain requires the exposed phenolic insulation foam to be covered with tape. The shoe tap requires installation with mechanical fasteners with gasket/sealer in accordance with the PDCS. Reference Figure 4-16.

EE. Rectangular phenolic duct branch connections to mains or submains are permitted to be non-flanged provided the duct greatest dimensions does not exceed 24 in. (600 mm) and the duct pressure class does not exceed 2 in. w.g. (500 Pa). Reference Figure 4-15.

FF. Rectangular phenolic duct branch connections to mains or submains are required to be flanged if the branch duct greatest dimension is greater than 24 in. (600 mm) or the duct pressure class is greater than 2 in. w.g. (500 Pa). Reference Figure 4-14.

GG. All rectangular phenolic duct branches that connect to mains or submains that utilize a flanged connection shall be fitted with a "B" Flange. Openings in mains and submains shall be fitted with a "D" Flange. The connection between the branch "B" Flange and the main/submain "D" Flange shall include a gasket and be mechanically fastened with screws or rivets in accordance with details in the PDCS. Reference Figure 4-14.

HH. All rectangular phenolic duct branches that connect to a main or submain that do not utilize a flanged connection shall be fabricated and installed in accordance with the PDCS. Reference Figure 4-15.

Branch take-off 45 degree cut connection option to include adhesive applied inside the joint and sealer at the exterior perimeter of the joint. Inside the duct, tape is required to cover the inside corner of the joint.

Branch take-off 90 degree cut connection option requires the exposed phenolic insulation foam at the cut opening at the main or submain to be covered with tape. The branch fitting end that connects to the main or submain shall also be covered with tape. Phenolic duct fastener(s) shall be provided at the duct joint exterior with fastener spacing in accordance with the PDCS. Sealer applied to the exterior perimeter of the joint.

II. All straight duct sections and all direction change and size change fittings in positive and negative pressure systems shall be reinforced as required herein by the PDCS. Reference Chapter 5.

JJ. For phenolic ducts with a dimension up to 44 in. (1100 mm), duct length segments are permitted to be 154 ¾ in (3930 mm) in length. For phenolic ducts with a dimension of more than 44 in (1100 mm) to 80 in. (2000 mm), duct length segments are limited to 47 ¼ in (1200 mm) in length. For duct(s) with a dimension over 80 in. (2000 mm), consult with the phenolic panel manufacturer.

KK. Installation of phenolic duct mounted air inlets/outlets shall be in conformance with the PDCS. Reference Figure 7-8.

LL. Phenolic duct connections to fans, HVAC equipment and other equipment shall be in conformance with the PDCS. Reference Figures 7-1, 7-7, 7-9 and 7-10.

MM. Illustrations of tie rod end fastenings on isometric drawings are not intended to restrict alternatives to the style shown unless the associated text limits the style.

NN. End Cap Reinforcement – Profile reinforcement may be required to withstand the pressure and limit the end cap deflection. Refer to the schedule of duct reinforcement for duct size and pressure requirements. When end cap reinforcement is required, mechanically fix end cap with reinforcing channel and fasteners in conformance with PDCS. Reference Figures 4-18 and 4-19 and Tables 4-1 and 4-2.

OO. Tie rod installations shall be in conformance with the PDCS. Reference Chapter 5.

PP. Flexible ducts and flexible connectors shall be of the type and ratings set forth by the designer. Where the manufacturer or a testing and listing authority does not prescribe otherwise they shall be connected by the PDCS and supported as required by the *HVAC DCS*.

QQ. Installed ducts must be free of visible damage, debris, moisture, sag, and significant misalignment

RR. The omission of reinforcement and complete closure details in drawings herein that are illustrating particular features shall not be used as grounds for omitting requirements that are elsewhere and otherwise specified. Some fittings may require reinforcement even though schedules for straight ducts of

the same space may show reinforcement is not required.

SS. The omission of referenced figures herein that are illustrating particular features shall not be used as grounds for omitting requirements that are elsewhere and otherwise specified.

3.2 CLOSURES

1. GENERAL

Closures systems are a vital element in the proper assembly of phenolic duct systems, providing both the structural connection and sealing of seams and joints. Only those closure systems that comply with UL 181A are suitable for use with rigid phenolic duct systems. Listed closures include:

A. Pressure sensitive aluminum foil tapes.

B. Sealer

C. Adhesive

D. Panel fasteners

E. Phenolic duct flanges

F. Four bolt flanges

Model codes and project specifications require that nonmetallic duct construction, which includes phenolic ducts, conform to UL 181, Class 1 requirements. Under UL 181A listing procedures, an individual closure system may be qualified for use on all manufacturer's phenolic panels which meet the UL 181 requirement. UL 181A tapes are imprinted for identification.

2. JOINT AND SEAM PREPARATION

Longitudinal seams and longitudinal corners are prepared as described herein and in Figures 3-1 and 3-2. Transverse joints between two duct sections are prepared as described herein and in Figures 3-3 through 3-9.

3. SEAMS AND JOINTS CLOSURE

A. Longitudinal Seams and Longitudinal Corners:

For the purposes of the PDCS, a longitudinal seam is defined as joining of two unattached longitudinally (in the direction of airflow) oriented mitered edges of phenolic panel material occurring between two joints. A longitudinal corner is defined as joining by folding of two attached (via phenolic panel exterior facing) longitudinally (in the direction of airflow) oriented mitered edges of phenolic panel material occurring between two joints.

Adhesive/tape or panel fasteners/tape is required at all longitudinal seams. Adhesive or panel fasteners/tape is required at longitudinal corners as specified in the PDCS. Tape is always applied over panel fasteners.

The application of adhesive/tape or panel fasteners/tape is to be in conformance with the PDCS including but not limited to as indicated in Figures 3-1, 3-2 and 4-7.

Regardless of the type of construction of longitudinal seams and longitudinal corners, a continuous unbroken bead of sealer is always placed in all four interior corners extending the full length of duct.

B. Transverse Joints, Non-Flanged:

Both ends of the duct must be flat and perfectly squared. Tape is applied on both ends of the duct segments. Apply a continuous bead of sealer to one end of one segment. The two duct segments are joined together. Air stream facings are to be carefully aligned to ensure specified internal duct dimensions are achieved. Panel fasteners are placed on all four corners and on all four sides of the duct at the connection. Apply tape around the connection of the two duct segments. Refer to Figure 3-3 for details.

C. Transverse Joints, "A" Flange

For 1 3/16 in. (30 mm) panel, tape is applied to the corners at ends of both duct segments to seal the exposed insulation. Tape is not required at the corners at the ends of the 7/8 in. (22 mm) panel.

Flange sections are cut to fit and applied to the duct end with light pressure until the total flange assembly is formed. Only when one piece is properly engaged and correctly positioned, it should be firmly positioned into the final locking grip using a rubber mallet. Sealer is applied to the flange sections as indicated. Refer to Figures 3-4 – 3-7.

At the end of one segment of duct, apply a continuous gasket to effectively seal the flange and the corners. Position the two duct segments together. Use "A" flange drive cleats to connect the duct segments

D. Transverse Joints, Optional "B/C" Flange:

For 1 3/16 in. (30 mm) panel, tape is applied to the corners at ends of both duct segments to seal the exposed insulation. Tape is not required at the corners at the ends of the 7/8 in. (22 mm) panel.

Flange sections are cut to fit and applied to the duct end with light pressure until the total flange assembly is formed. Only when one piece is properly engaged and correctly positioned, it should be firmly positioned into the final locking grip using a rubber mallet. Sealer is applied to the flange sections as indicated. Refer to Figures 3-4 – 3-6 and 3-8.

At the end of one segment of duct, apply a continuous gasket to effectively seal the flange and the corners. Position the two duct segments together. Use rivets or screws fasten the duct segments.

E. Transverse Joints, 4 Bolt Flange:

Prior to insertion of the 4-Bolt Flange, the ends of the duct section are required to be sealed with UL listed aluminum tape and then gently tapered with a phenolic panel rigid Spatula. The four pieces of 4-Bolt Flange are cut to the internal dimension of the corresponding side of the duct less ¾ in. (19mm). The 4-Bolt Flange uses minimum 20 gage (1 mm) pressed steel corners. First, the four pieces of flange and corners are assembled together to form a frame, then a bead of sealer is applied inside the flange, on both internal edges of the flange. Finally, the whole frame is fitted onto the edge of the duct.

After the flange has been fully attached, apply a continuous gasket to effectively seal the flange and the corners. Note that it is only applied on one of the two duct sections being joined together. Four bolts are used to join the two duct sections together. Additional metal clips are required on the flange at 3 in. (75 mm) from the corners, further metal clips are required along the flange so that the joint is kept closed without gaps – maximum 12 in. (300mm) centers required. Reference Figure 3-9.

F. Flanged Transverse Joints ("A" Flange, Optional "B/C" Flange, 4 Bolt Flange):

* The designer shall consider the possibility and consequences of condensation occurring on mechanical flanges and shall specify control measures.

4. SURFACE PREPARATION

In order to obtain satisfactory adhesion and bonding, the surface on which closures will be applied must be clean and dry. Dust, dirt, oil, grease, moisture, and similar substances may result in adhesion and bonding failure when present. In many cases, wiping the application surface with an oil free, lint free rag, or paper towel would be sufficient. However, for the best results on contaminated surfaces, the cleaning recommendations of the tape manufacturer should be consulted.

5. SHELF LIFE

Tapes, sealers and adhesives often have storage requirements and shelf life limitations. The installer shall verify that these conditions have not been exceeded prior to use.

NOTES:

a. *Manufacturer's closure application instructions must be followed.*

b. *See mechanical reinforcement requirements at seams and joints in the reinforcement's provisions.*

* NOTES FOR THE SPECIFIER

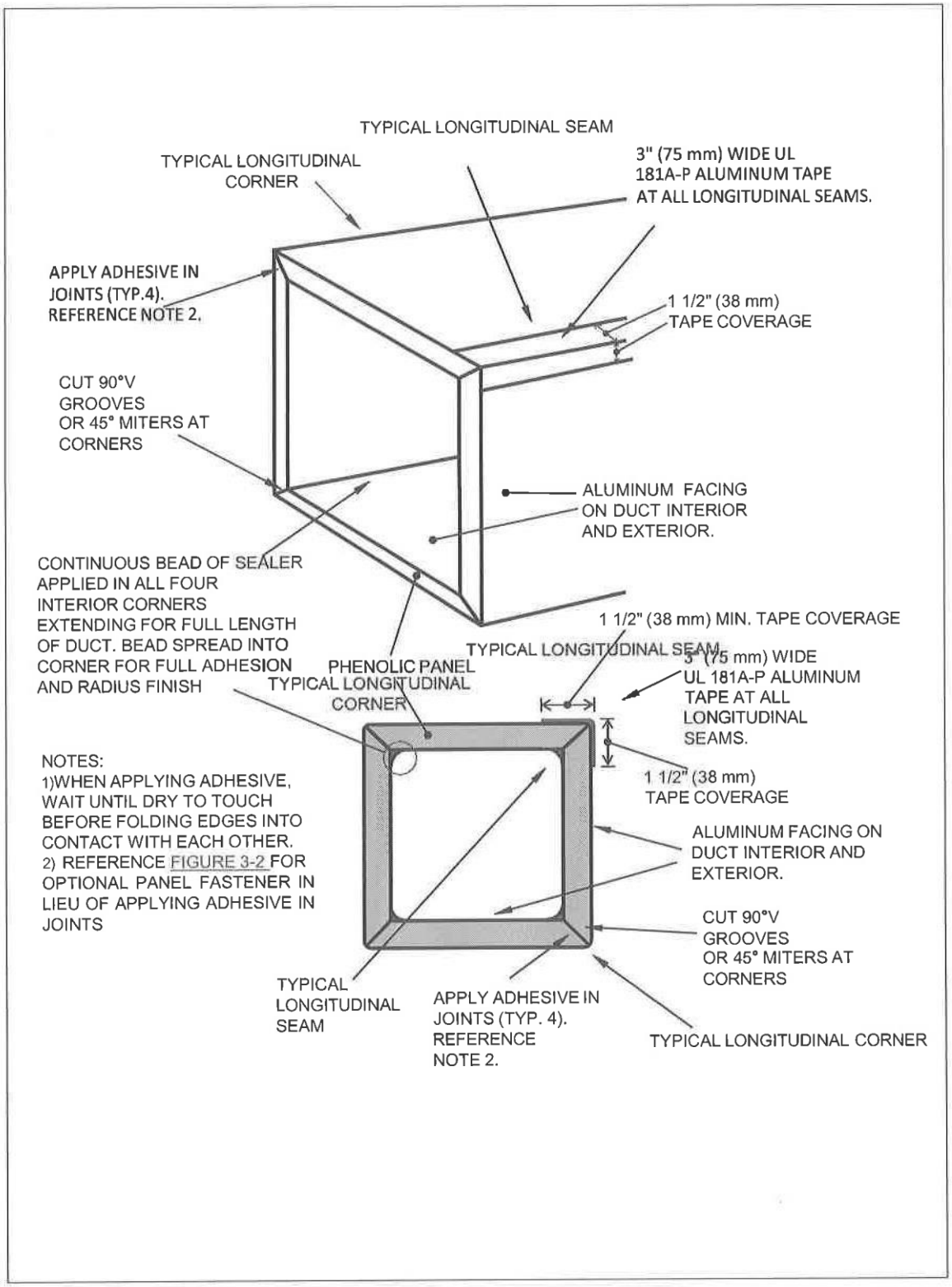
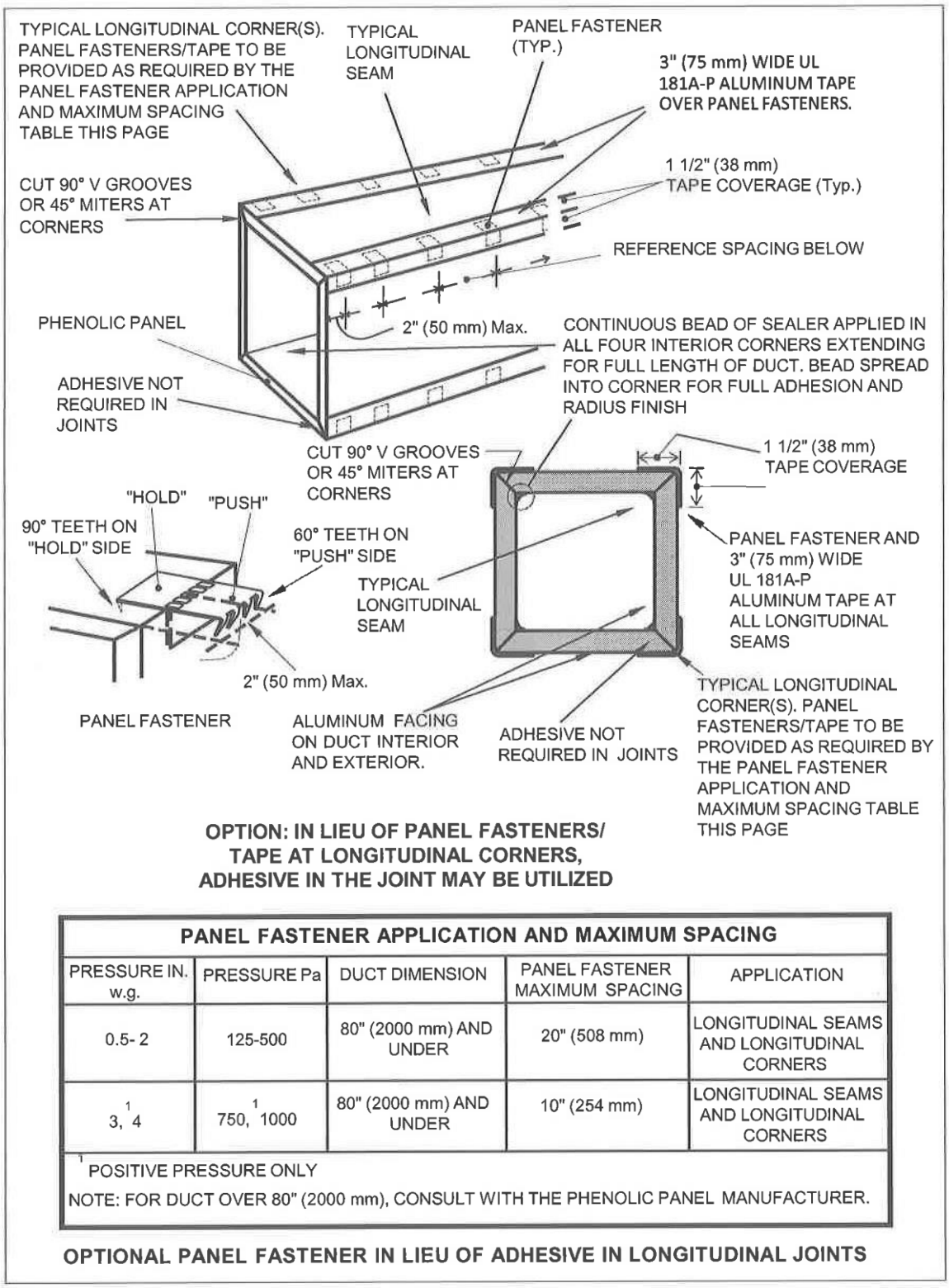


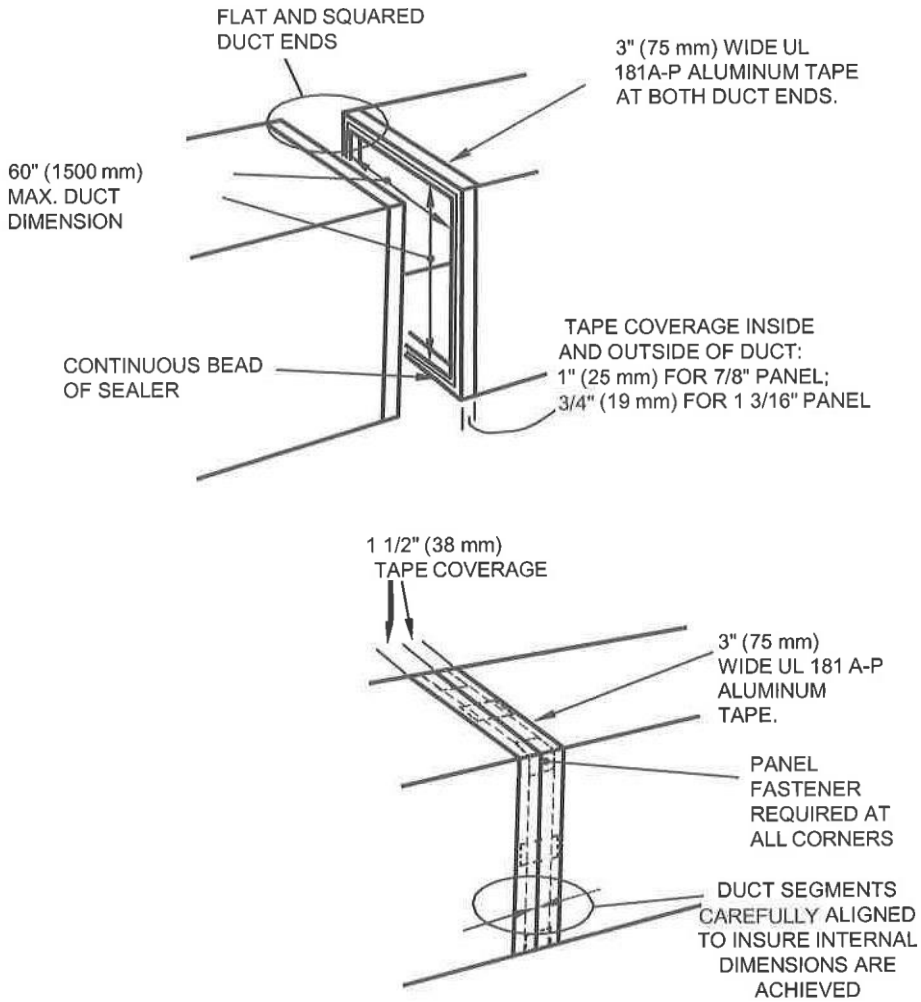
FIGURE 3-1 CLOSURES



PANEL FASTENER APPLICATION AND MAXIMUM SPACING				
PRESSURE IN. w.g.	PRESSURE Pa	DUCT DIMENSION	PANEL FASTENER MAXIMUM SPACING	APPLICATION
0.5- 2	125-500	80" (2000 mm) AND UNDER	20" (508 mm)	LONGITUDINAL SEAMS AND LONGITUDINAL CORNERS
[1] 3, 4	[1] 750, 1000	80" (2000 mm) AND UNDER	10" (254 mm)	LONGITUDINAL SEAMS AND LONGITUDINAL CORNERS
[1] POSITIVE PRESSURE ONLY NOTE: FOR DUCT OVER 80" (2000 mm), CONSULT WITH THE PHENOLIC PANEL MANUFACTURER.				

OPTIONAL PANEL FASTENER IN LIEU OF ADHESIVE IN LONGITUDINAL JOINTS

FIGURE 3-2 CLOSURES



PANEL FASTENER QTY FOR NON-FLANGED JOINT

DUCT DIMENSION		* PANEL FASTENER QTY	MAX. PRESSURE	
IN.	MM		IN. w.g.	Pa
4-5	100-150	0	2	500
6-11	151-300	1	2	500
12-19	301-500	2	2	500
20-39	501-1000	3	2	500
40-44	1001-1156	4	2	500
46-45	1157-1250	4	1	250
50-60	1251-1500	5	1	250

* PER SIDE; IN ADDITION TO CORNERS

FIGURE 3-3 CLOSURES – NON-FLANGED

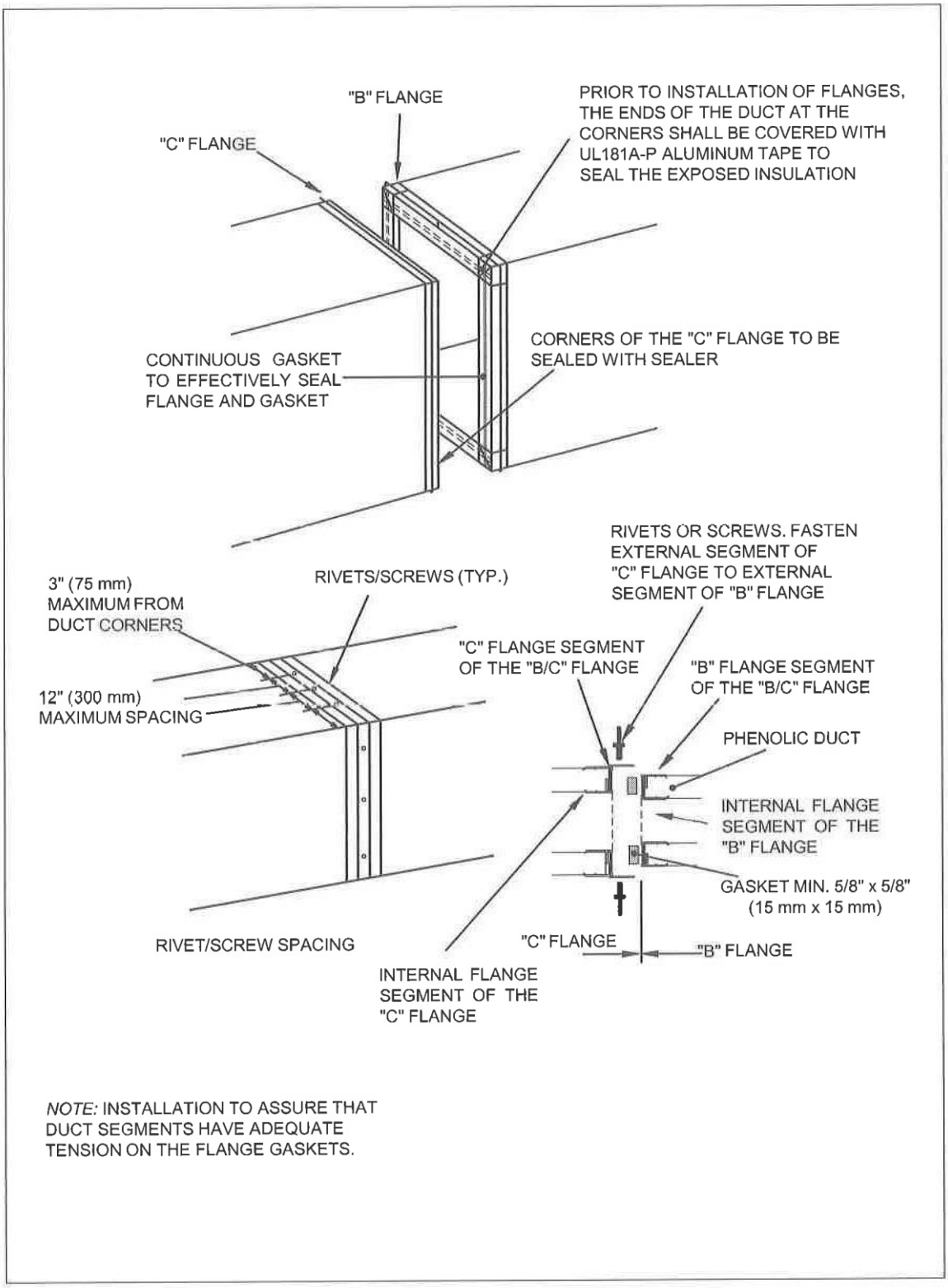


FIGURE 3-8 CLOSURES – OPTIONAL "B/C" FLANGE

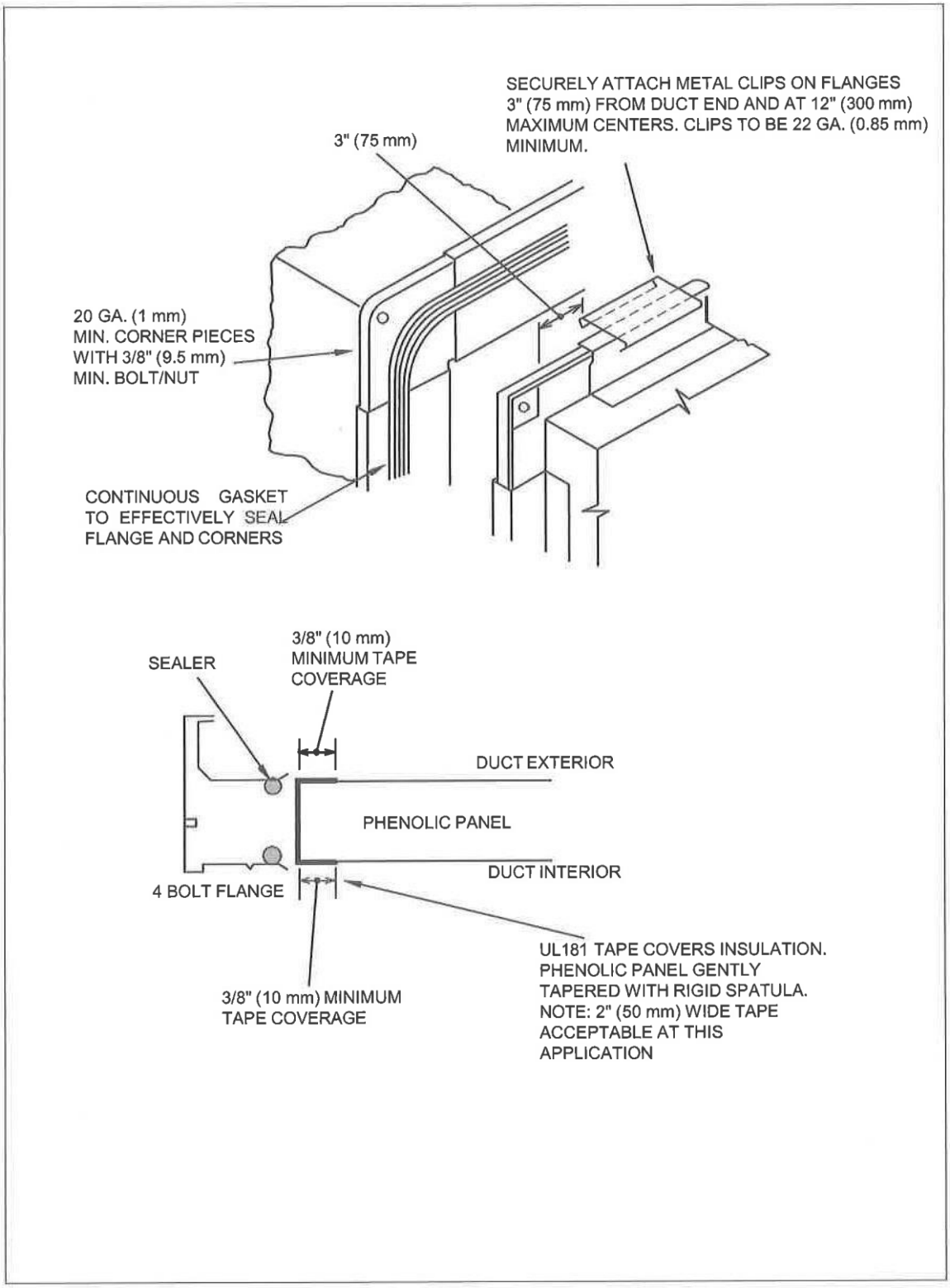
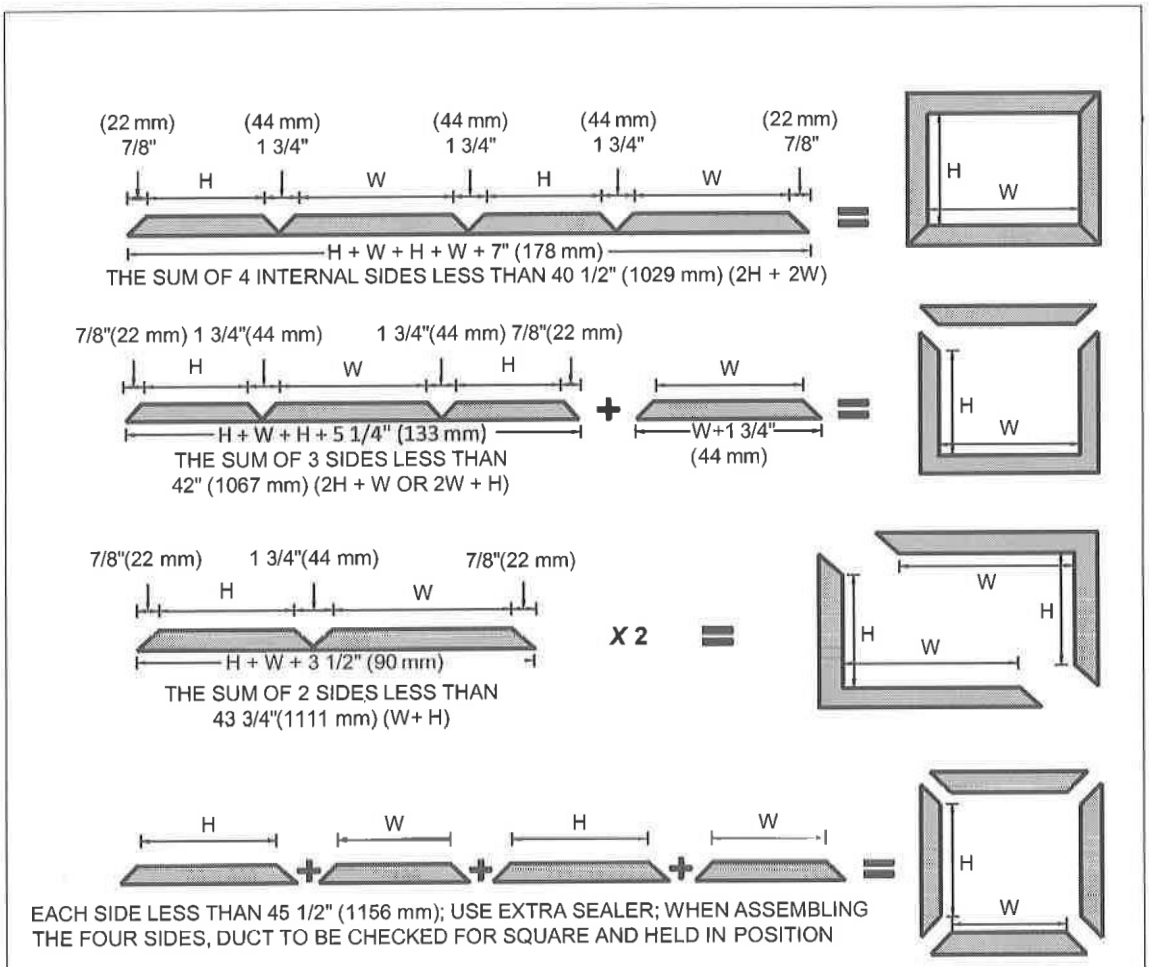


FIGURE 3-9 CLOSURES – 4 BOLT FLANGE



NOTES:

1)CUT CORNERS TO BE 90° V GROOVES OR 45° MITERS. ASSEMBLY OF CORNERS WITH SHIPLAP JOINTS IS NOT PERMITTED.

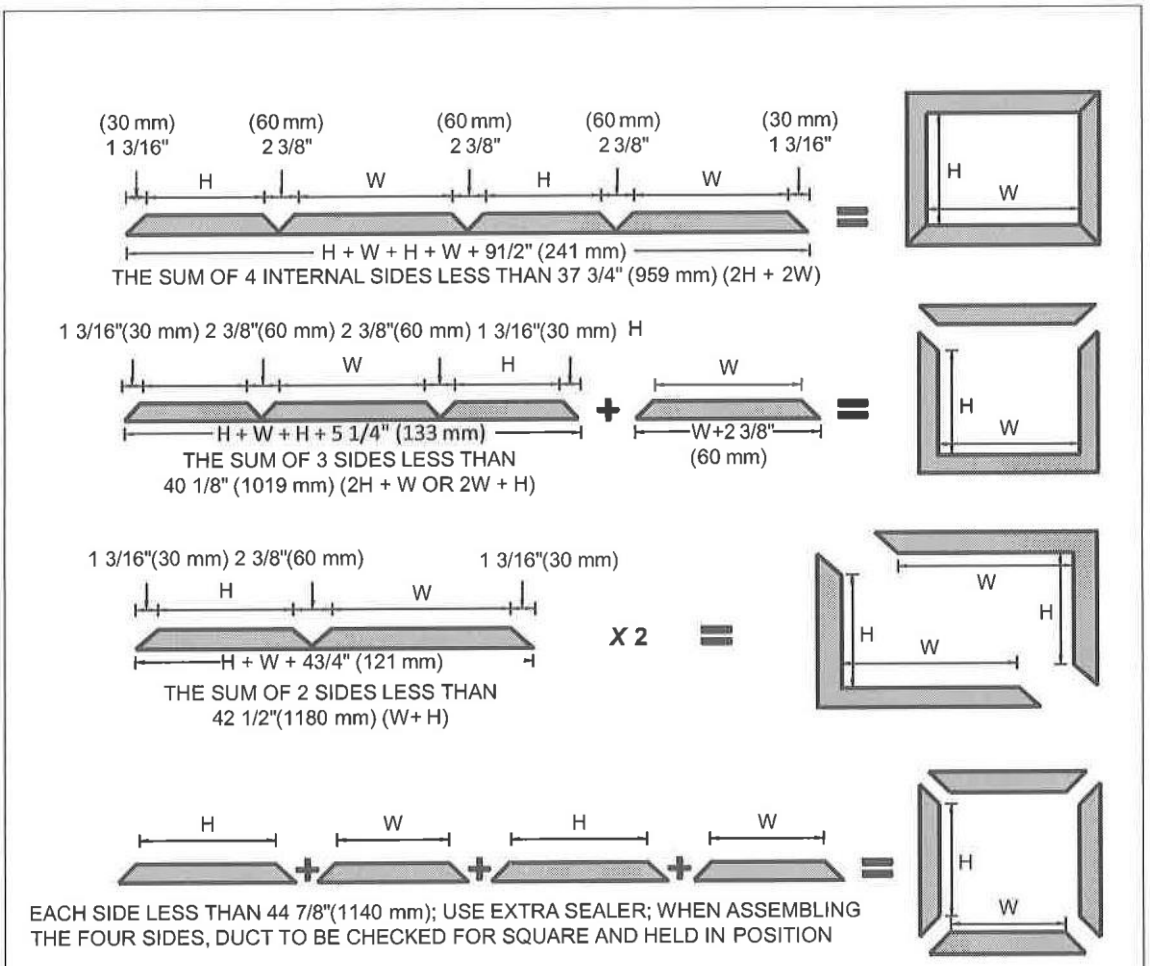
2)3" (76 mm) WIDE UL 181A-P ALUMINUM TAPE AT ALL LONGITUDINAL SEAMS. TAPE MUST BE ESSENTIALLY FREE OF WRINKLES, UNIFORMLY ADHERED AND PRESSED SUFFICIENTLY TO SHOW DUCT FACING REINFORCEMENT IMPRESSIONS IN THE TAPE.

3) 1 1/2" (38 mm) TAPE COVERAGE AT EACH CONTACT SURFACE.

4)WHEN APPLYING ADHESIVE, WAIT UNTIL DRY TO TOUCH BEFORE FOLDING EDGES INTO CONTACT WITH EACH OTHER. USE STIFF SPATULA.

5)CONTINUOUS BEAD OF SEALER APPLIED IN ALL FOUR INTERIOR CORNERS EXTENDING FOR FULL LENGTH OF DUCT. BEAD SPREAD INTO CORNER FOR FULL ADHESION AND RADIUS FINISH.

FIGURE 3-10 CLOSURES – 7/8 IN. (22 MM) PANEL



NOTES:

1)CUT CORNERS TO BE 90° V GROOVES OR 45° MITERS. ASSEMBLY OF CORNERS WITH SHIPLAP JOINTS IS NOT PERMITTED.

2)3" (76 mm) WIDE UL 181A-P ALUMINUM TAPE AT ALL LONGITUDINAL SEAMS. TAPE MUST BE ESSENTIALLY FREE OF WRINKLES, UNIFORMLY ADHERED AND PRESSED SUFFICIENTLY TO SHOW DUCT FACING REINFORCEMENT IMPRESSIONS IN THE TAPE.

3) 1 1/2" (38 mm) TAPE COVERAGE AT EACH CONTACT SURFACE.

4)WHEN APPLYING ADHESIVE, WAIT UNTIL DRY TO TOUCH BEFORE FOLDING EDGES INTO CONTACT WITH EACH OTHER. USE STIFF SPATULA.

5)CONTINUOUS BEAD OF SEALER APPLIED IN ALL FOUR INTERIOR CORNERS EXTENDING FOR FULL LENGTH OF DUCT. BEAD SPREAD INTO CORNER FOR FULL ADHESION AND RADIUS FINISH.

FIGURE 3-11 CLOSURES – 1 3/16 IN. (30 MM) PANEL

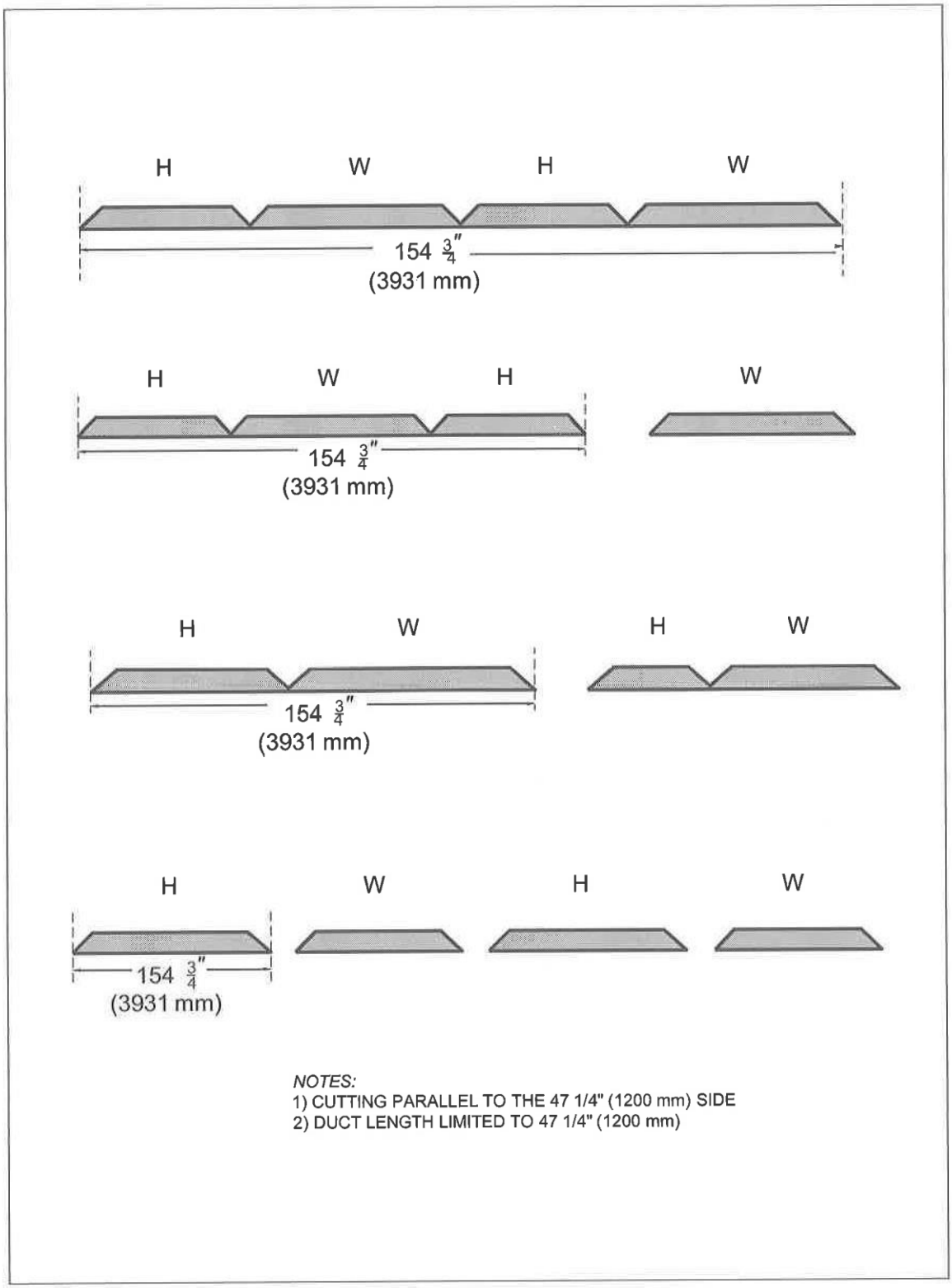
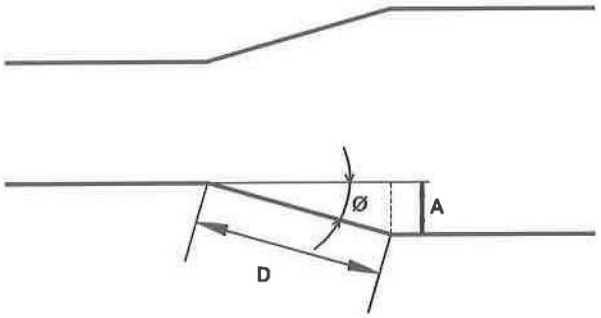
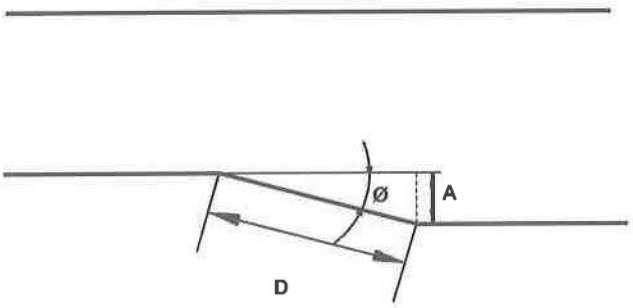


FIGURE 3-12 CLOSURES – DUCT WIDTH OR HEIGHT OVER 47 1/4 IN. (1200 MM)



CONCENTRIC TRANSITION
Ø MAX . 22.5 ° (D MIN. =2.5 *X* A)



ECCENTRIC TRANSITION
Ø MAX. 22.5 ° (D MIN. =2.5 *X* A)

SPLITTERS ARE REQUIRED FOR ANGLES GREATER THAN 22.5 DEGREES

FIGURE 4-1 TRANSITIONS

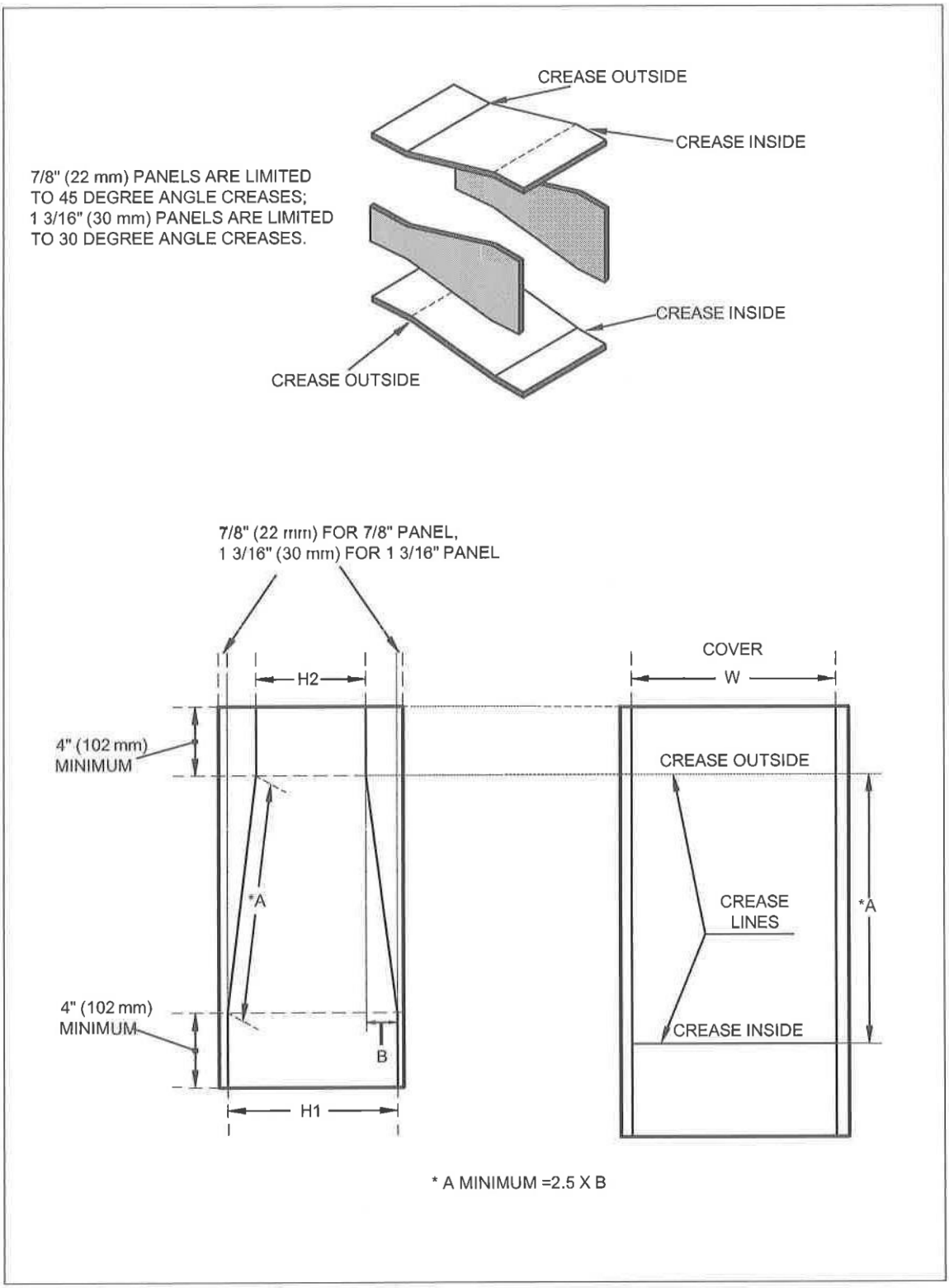


FIGURE 4-2 CONCENTRIC REDUCER

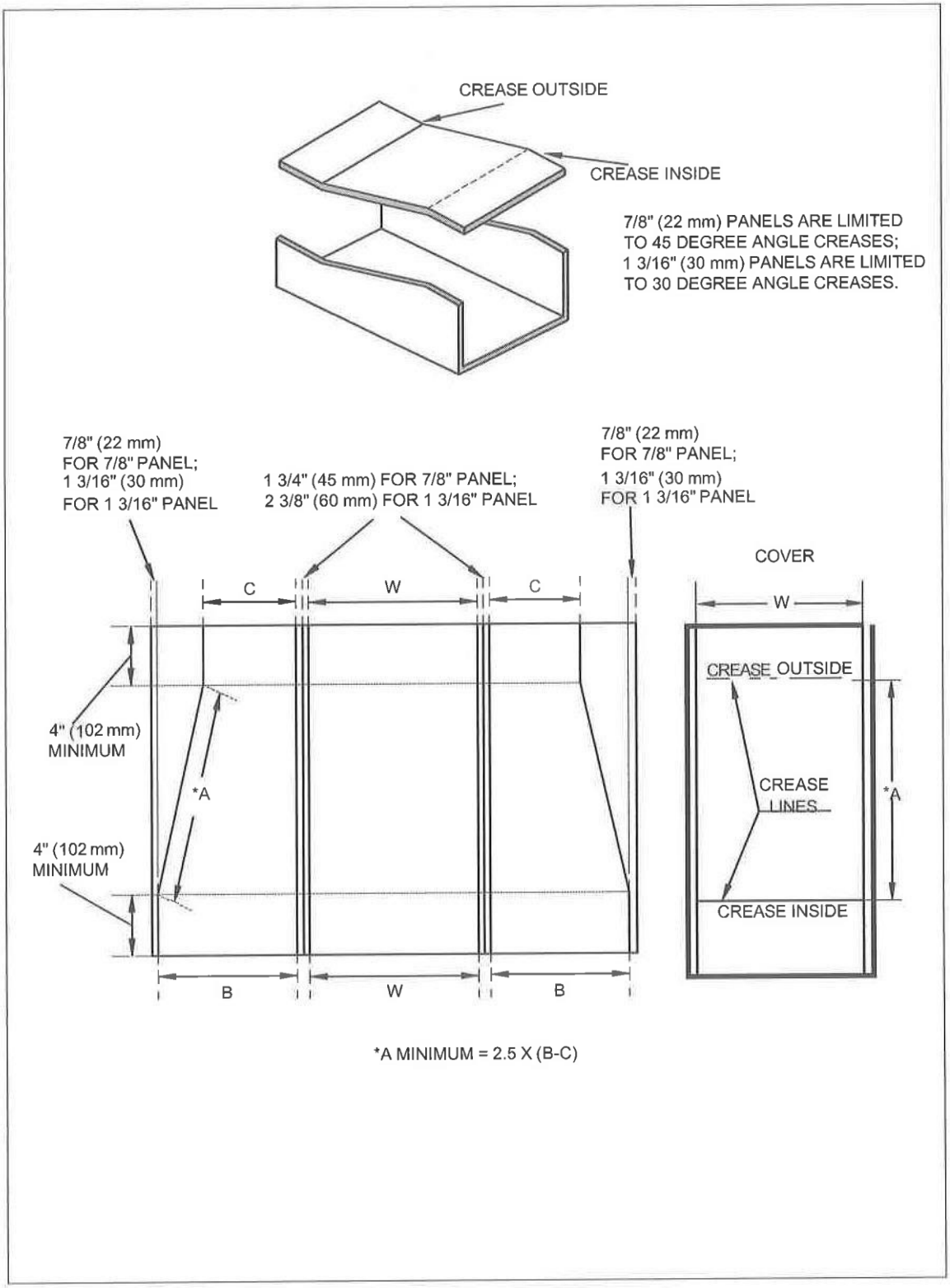
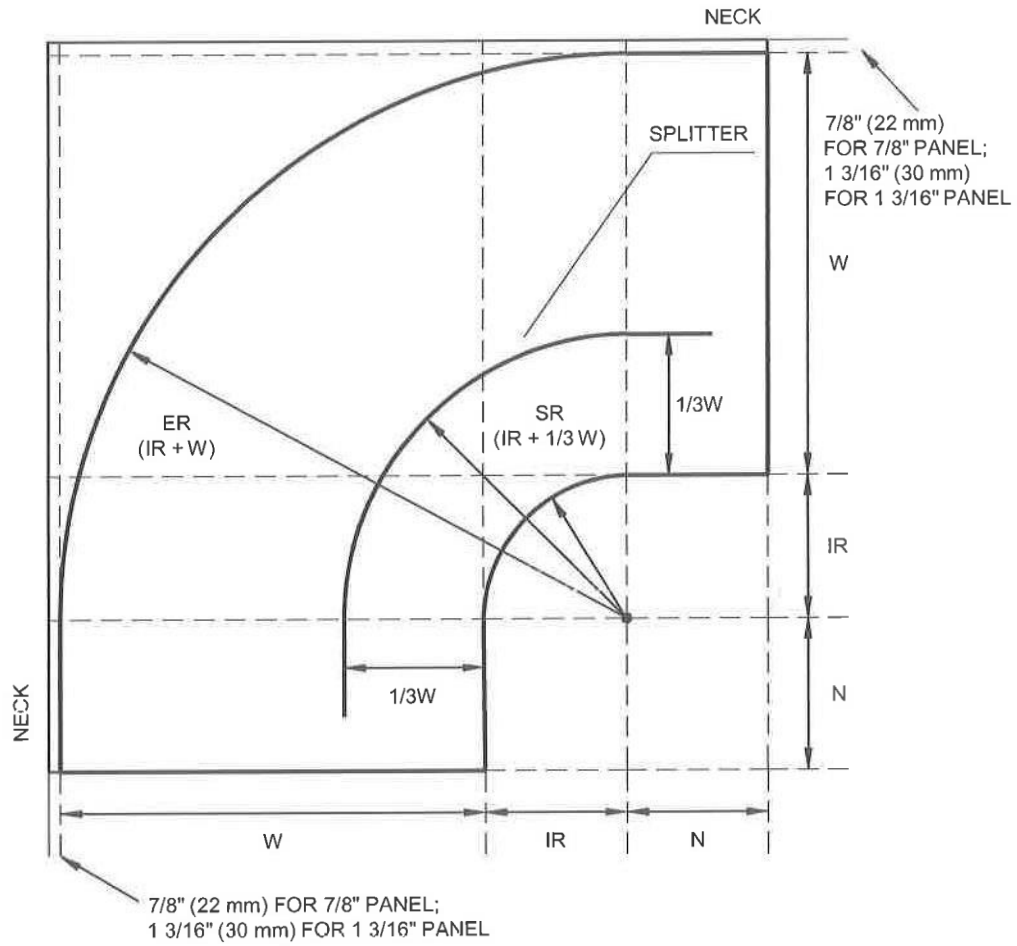


FIGURE 4-3 ECCENTRIC REDUCER



LEGEND
N = NECK
ER = EXTERNAL RADIUS
IR = INTERNAL RADIUS
SR = SPLITTER RADIUS

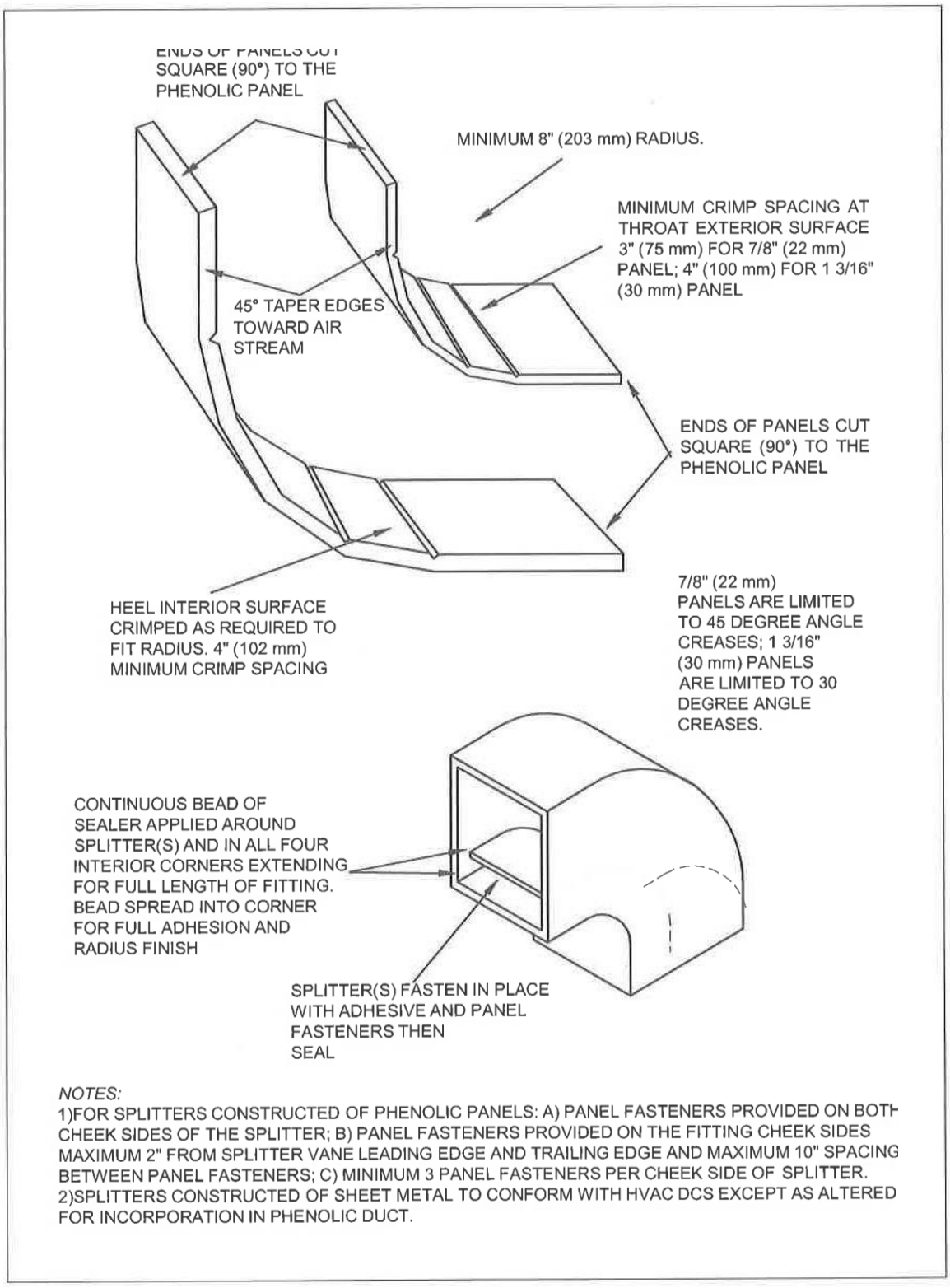
NOTES:
1) MIN. BEND RADIUS: 8" (203 mm)
2) MIN. NECK: 4" (102 mm)
3)CRIMP RADIUS PANELS: THROAT 3"(76 mm) MIN.; HEEL 4" (102 mm) MIN. REFERENCE FIGURE 4-6
4) SPLITTER VANE POSITION MEASURED FROM THE FITTING THROAT AT THE DUCT INTERIOR

SPLITTER VANES

DUCT WIDTH IN.	DUCT WIDTH MM	SPLITTER VANE(S) REQUIRED	SPLITTER VANE(S) POSITION
0 - 20	0 - 508	0	NA
> 20 - 32	> 508 - 813	1	W/3
> 32 - 64	> 813 - 1626	2	W/4, W/2
> 64	> 1626	3	W/8, W/3, W/2

1) SPLITTER VANES NOT REQUIRED IN ANGLES LESS THAN 45 DEGREES
2) OPTION - REFER TO SMACNA *HVAC DUCT CONSTRUCTION STANDARDS* FOR VANE QUANTITY SELECTION

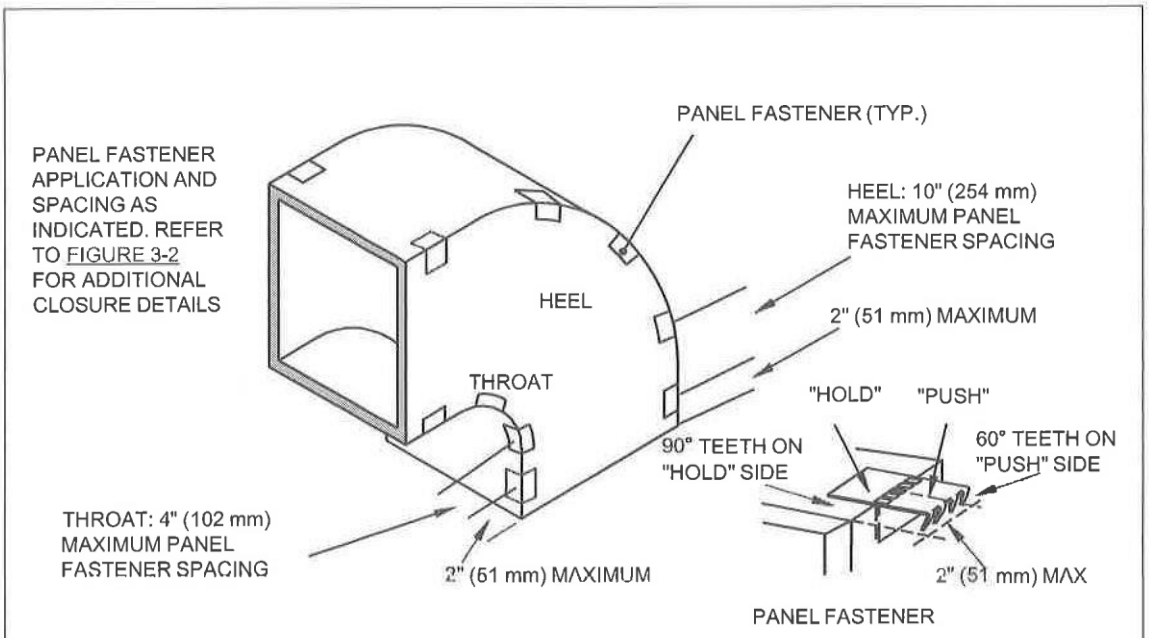
FIGURE 4-4 ELBOW - SYMMETRIC



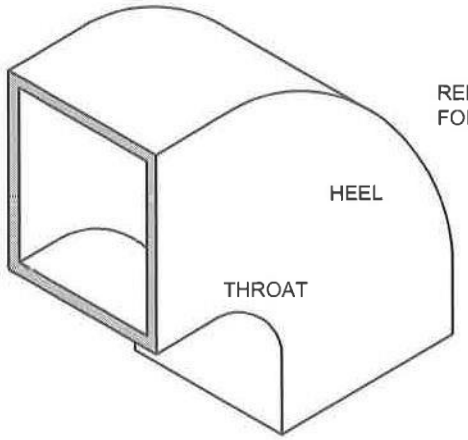
NOTES:

1)FOR SPLITTERS CONSTRUCTED OF PHENOLIC PANELS: A) PANEL FASTENERS PROVIDED ON BOTH CHEEK SIDES OF THE SPLITTER; B) PANEL FASTENERS PROVIDED ON THE FITTING CHEEK SIDES MAXIMUM 2" FROM SPLITTER VANE LEADING EDGE AND TRAILING EDGE AND MAXIMUM 10" SPACING BETWEEN PANEL FASTENERS; C) MINIMUM 3 PANEL FASTENERS PER CHEEK SIDE OF SPLITTER.
2)SPLITTERS CONSTRUCTED OF SHEET METAL TO CONFORM WITH HVAC DCS EXCEPT AS ALTERED FOR INCORPORATION IN PHENOLIC DUCT.

FIGURE 4-6 ELBOW - SYMMETRIC - ASYMMETRIC

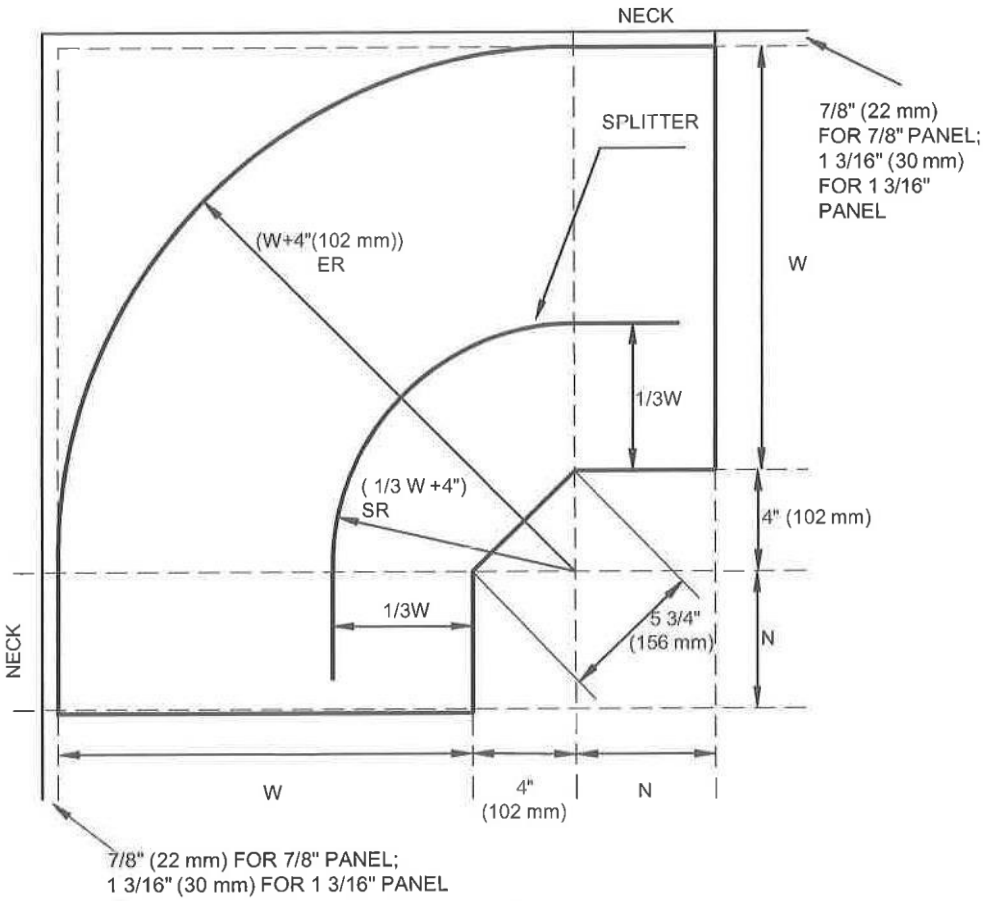


RADIUS FITTING OPTIONAL PANEL FASTENER. REFERENCE TABLE 4-3



RADIUS FITTING ADHESIVE IN LONGITUDINAL SEAMS/CORNERS. REFERENCE TABLE 4-3

FIGURE 4-7 ELBOW CLOSURE SPACING



LEGEND
N = NECK
ER = EXTERNAL RADIUS
IR = INTERNAL RADIUS
SR = SPLITTER RADIUS

NOTES:
1) MIN. BEND RADIUS: 8" (203 mm)
2) MIN. NECK: 4" (102 mm)
3)CRIMP RADIUS PANELS: THROAT 3" (76 mm) MIN.; HEEL 4" (102 mm) MIN. REFERENCE FIGURE 4-6
4) SPLITTER VANE POSITION MEASURED FROM THE FITTING THROAT AT THE DUCT INTERIOR

SPLITTER VANES

DUCT WIDTH IN.	DUCT WIDTH MM	SPLITTER VANE(S) REQUIRED	SPLITTER VANE(S) POSITION
0 - 20	0 - 508	0	NA
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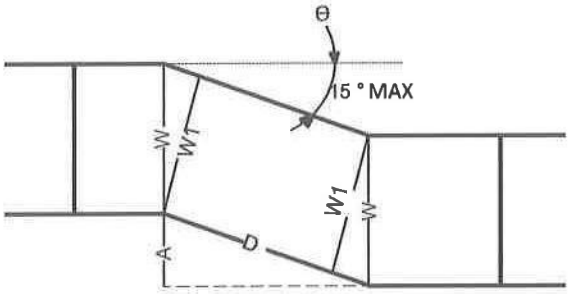
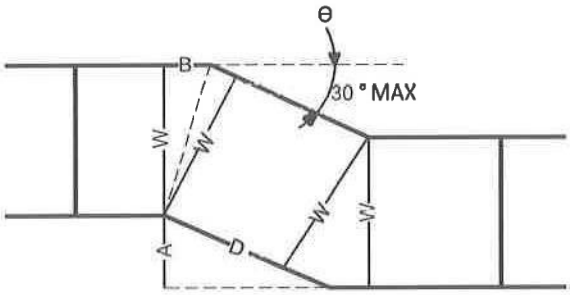
> 32 - 64	> 813 - 1626	2	W/4, W/2
> 64	> 1626	3	W/8, W/3, W/2

1)SPLITTER VANES NOT REQUIRED IN ANGLES LESS THAN 45 DEGREES
2)OPTION - REFER TO SMACNA *HVAC DUCT CONSTRUCTION STANDARDS* FOR VANE QUANTITY SELECTION

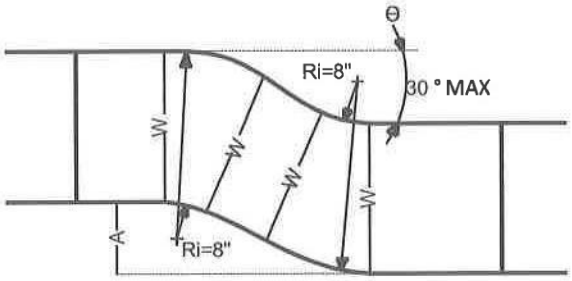
FIGURE 4-8 ELBOW 45 DEGREE THROAT - RADIUS HEEL - OPTIONAL DESIGN



ANGLED OFFSET
Θ MAX. 15 ° (D ≥ 4 x A)

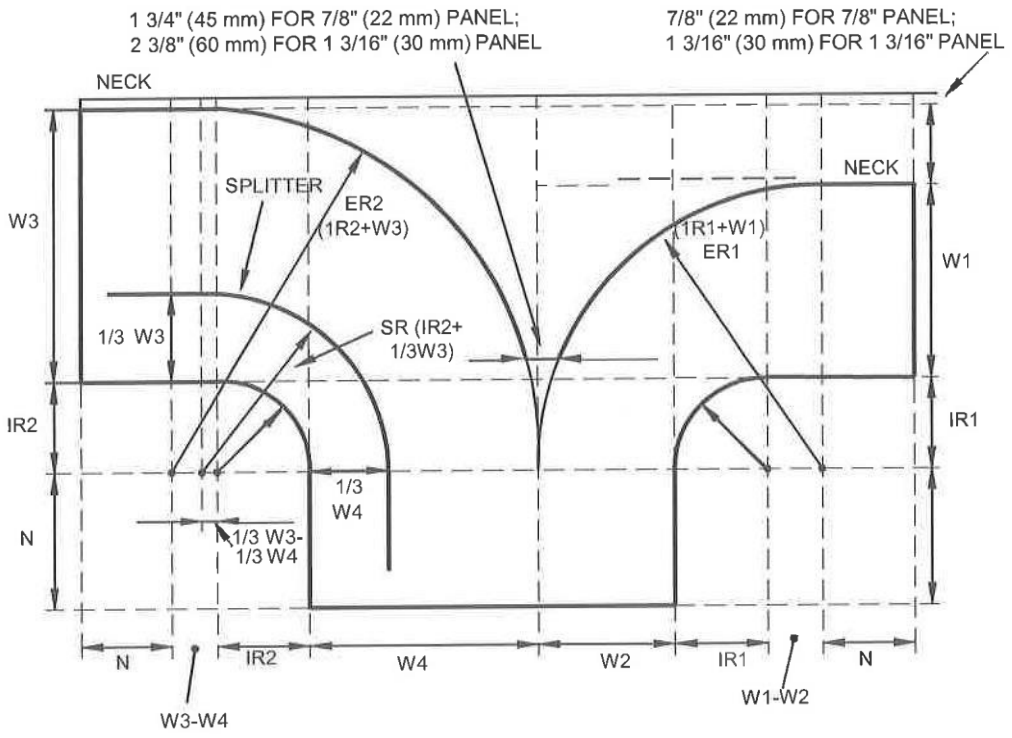


MITERED OFFSET
Θ MAX. 30 ° (D ≥ 2 x A)
(B=0.27 x W)



RADIUS OFFSET
Θ MAX. 30 °
(8" RADIUS MINIMUM)

FIGURE 4-9 OFFSETS



LEGEND
N = NECK
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IR = INTERNAL RADIUS
SR = SPLITTER RADIUS

NOTES:
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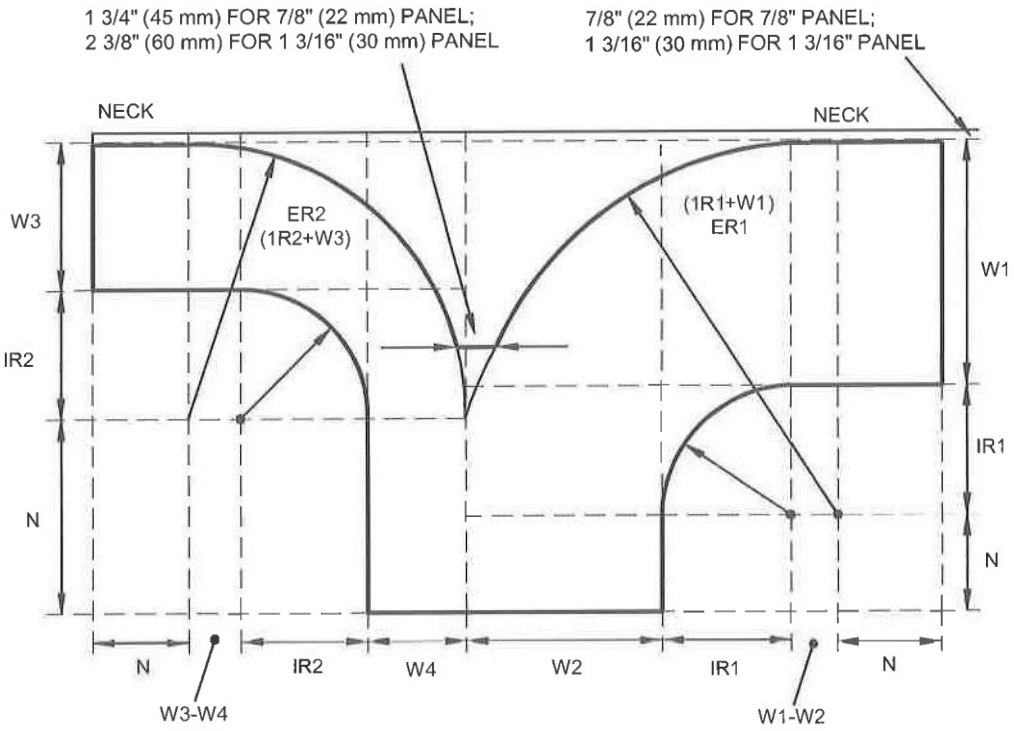
2) MIN. NECK: 4" (102 mm)
3) CRIMP RADIUS PANELS: THROAT 3" (76 mm) MIN.; HEEL 4" (102 mm) MIN. REFERENCE FIGURE 4-6
4) SPLITTER VANE POSITION MEASURED FROM THE FITTING THROAT AT THE DUCT INTERIOR

SPLITTER VANES

DUCT WIDTH IN.	DUCT WIDTH MM	SPLITTER VANE(S) REQUIRED	SPLITTER VANE(S) POSITION
0 - 20	0 - 508	0	NA
> 20 - 32	> 508 - 813	1	W/3
> 32 - 64	> 813 - 1626	2	W/4, W/2
> 64	> 1626	3	W/8, W/3, W/2

1) SPLITTER VANES NOT REQUIRED IN ANGLES LESS THAN 45 DEGREES
2) OPTION - REFER TO SMACNA *HVAC DUCT CONSTRUCTION STANDARDS* FOR VANE QUANTITY SELECTION

FIGURE 4-10 TEE BRANCH (THROAT SIDES FLUSHED)



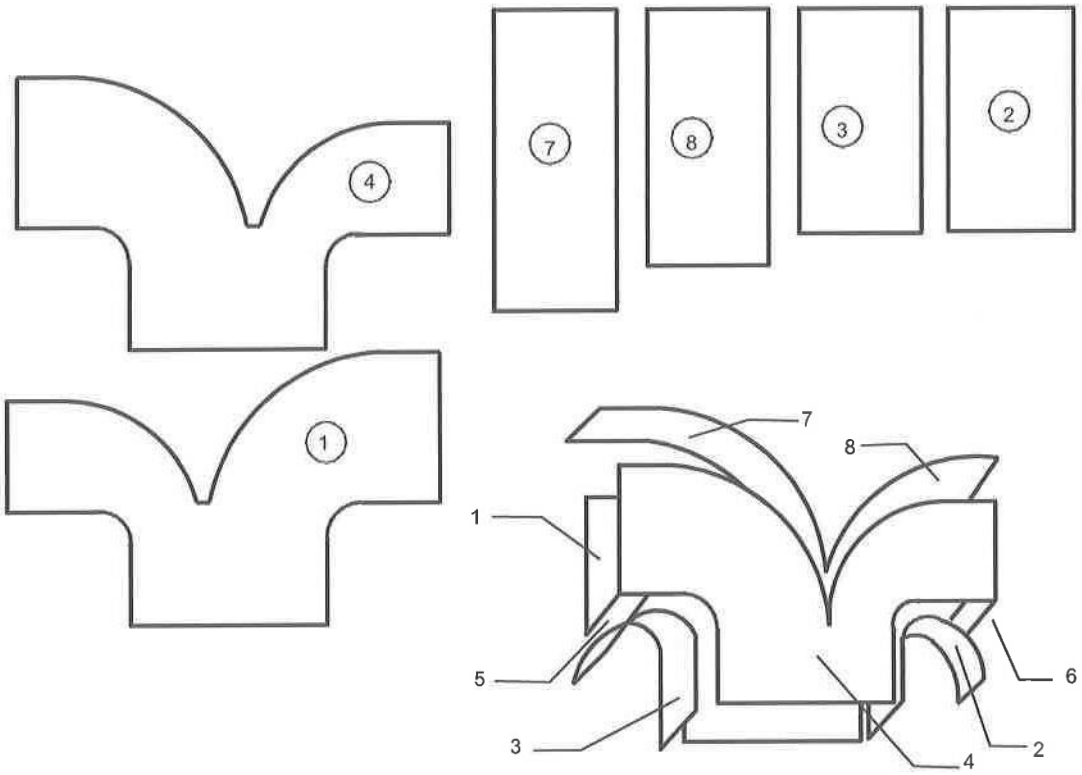
SPLITTER VANES			
DUCT WIDTH IN.	DUCT WIDTH MM	SPLITTER VANE(S) REQUIRED	SPLITTER VANE(S) POSITION
0 - 20	0 - 508	0	NA
> 20 - 32	> 508 - 813	1	W/3
> 32 - 64	> 813 - 1626	2	W/4, W/2
> 64	> 1626	3	W/8, W/3, W/2

1) SPLITTER VANES NOT REQUIRED IN ANGLES LESS THAN 45 DEGREES
2) OPTION - REFER TO SMACNA *HVAC DUCT CONSTRUCTION STANDARDS* FOR VANE QUANTITY SELECTION

LEGEND
N = NECK
ER = EXTERNAL RADIUS
IR = INTERNAL RADIUS
SR = SPLITTER RADIUS

NOTES:
1) MIN. BEND RADIUS: 8" (203 mm)
2) MIN. NECK: 4" (102 mm)
3) CRIMP RADIUS PANELS: THROAT 3" (76mm) MIN.; HEEL 4" (102 mm) MIN. REFERENCE FIGURE 4-6
4) SPLITTER VANE POSITION MEASURED FROM THE FITTING THROAT AT THE DUCT INTERIOR

FIGURE 4-11 TEE BRANCH (HEEL SIDES FLUSHED)



1) PLACE SECTION 1 ON TABLE
2) JOIN SECTION 2 AND 3 ONLY THE NECK SECTION
3) ADD HOLDER PLACES (SCRAPS) 5 AND 6 WITH TAPE ONLY AND NO ADHESIVE
4) INSTALL BIGGER CIRCUMFERENCE SECTION WITH COVER 7
5) INSTALL SECTION 8
6) REMOVE SECTION 5 AND ADHESIVE SECTION 3
7) REMOVE SECTION 6 AND ADHESIVE SECTION 2

FIGURE 4-12 TEE BRANCH ASSEMBLY

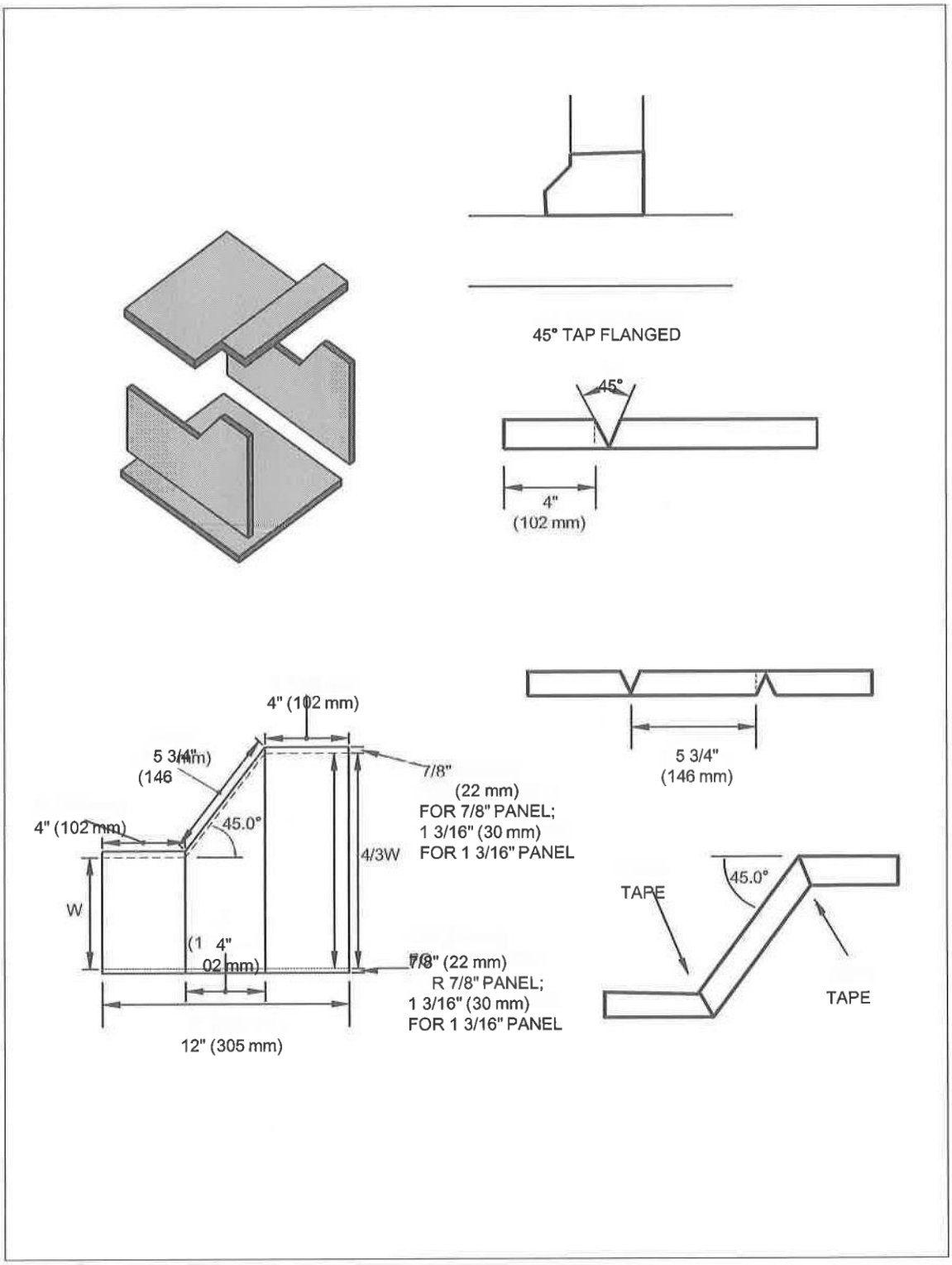


FIGURE 4-13 BRANCH CONNECTION - 45 DEGREE TAP - FLANGED

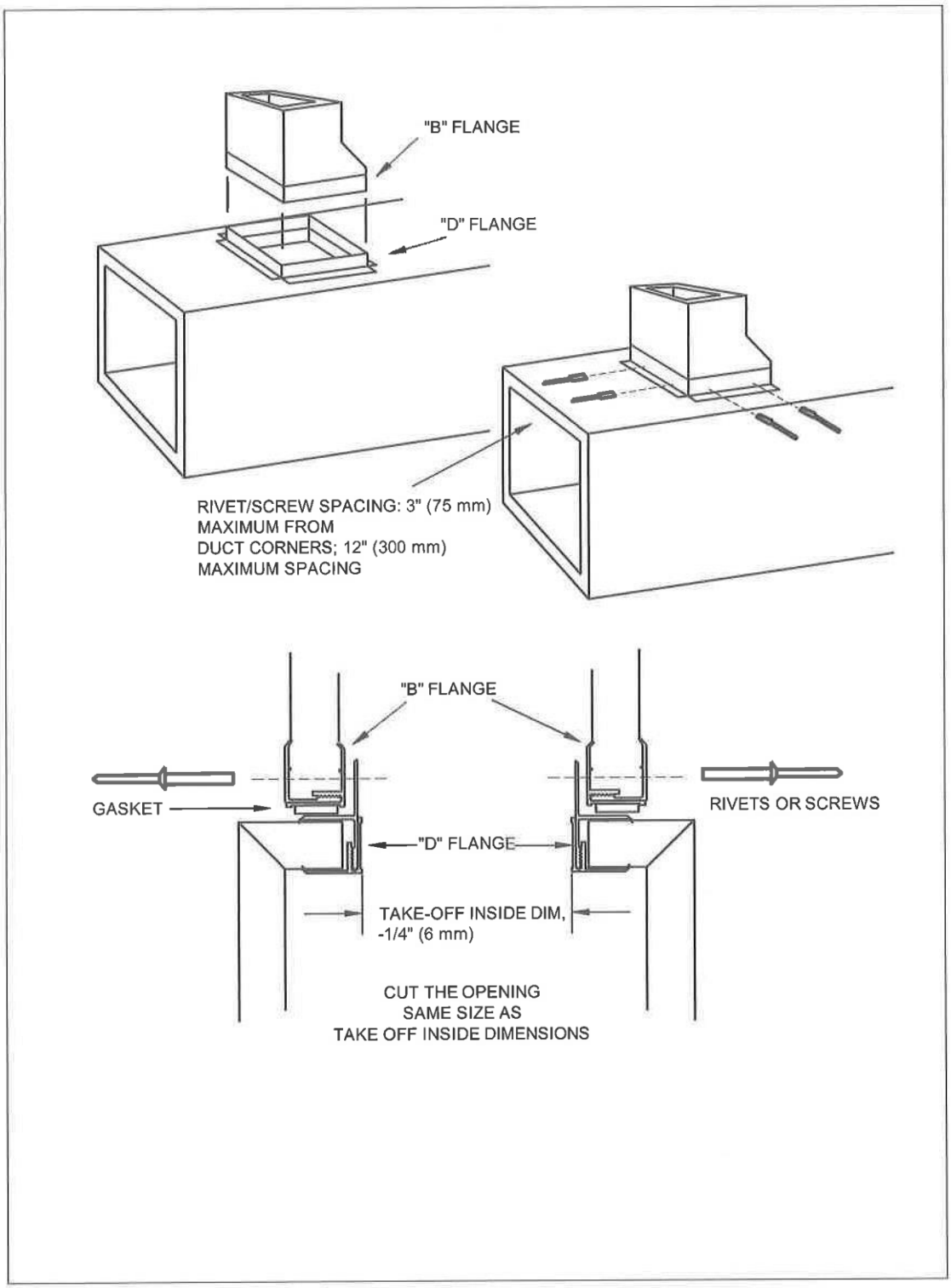
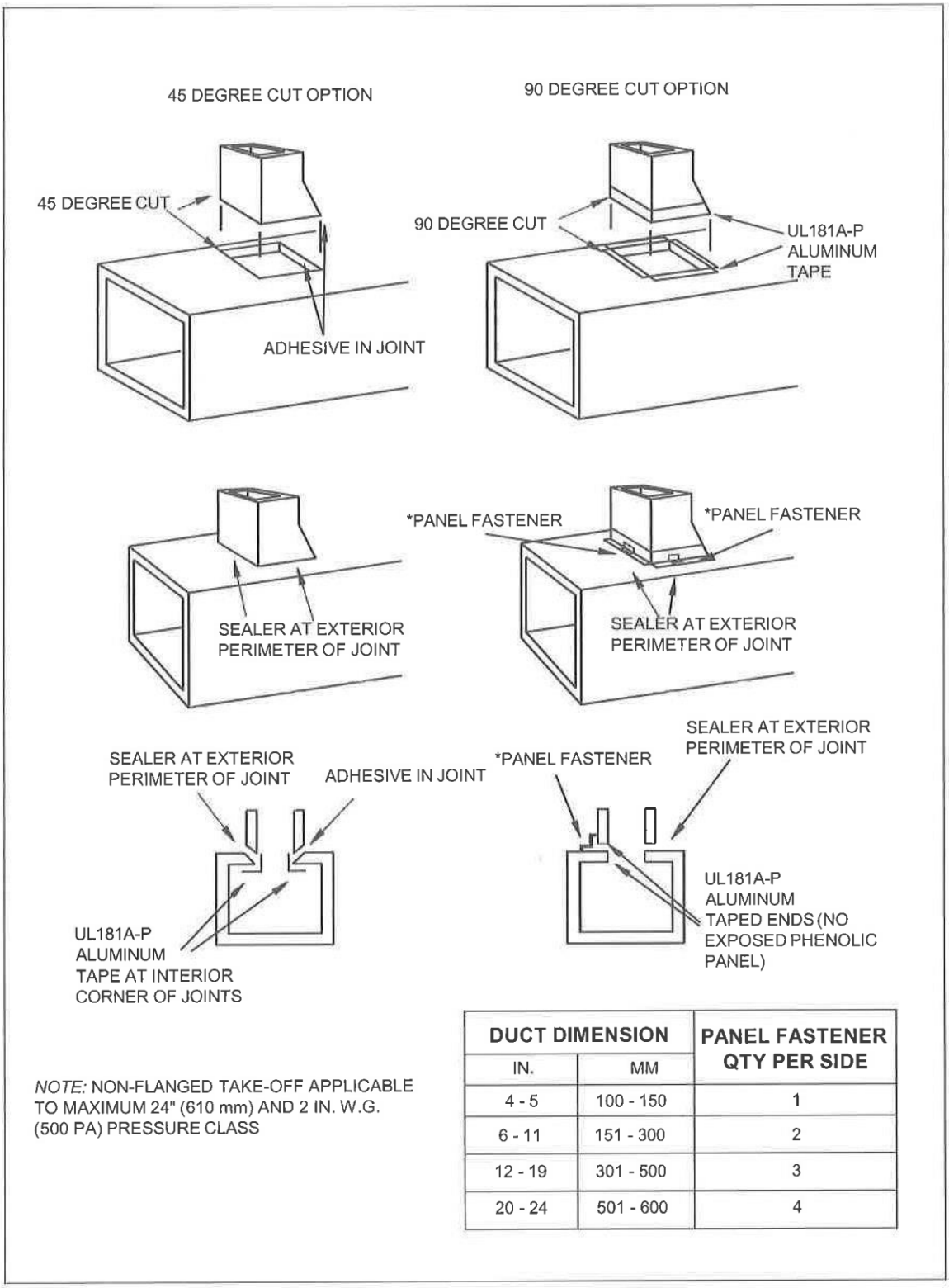


FIGURE 4-14 BRANCH CONNECTION - 45 DEGREE TAP - FLANGED



NOTE: NON-FLANGED TAKE-OFF APPLICABLE TO MAXIMUM 24" (610 mm) AND 2 IN. W.G. (500 PA) PRESSURE CLASS

DUCT DIMENSION		PANEL FASTENER QTY PER SIDE
IN.	MM	
4 - 5	100 - 150	1
6 - 11	151 - 300	2
12 - 19	301 - 500	3
20 - 24	501 - 600	4

FIGURE 4-15 BRANCH CONNECTION NON-FLANGED

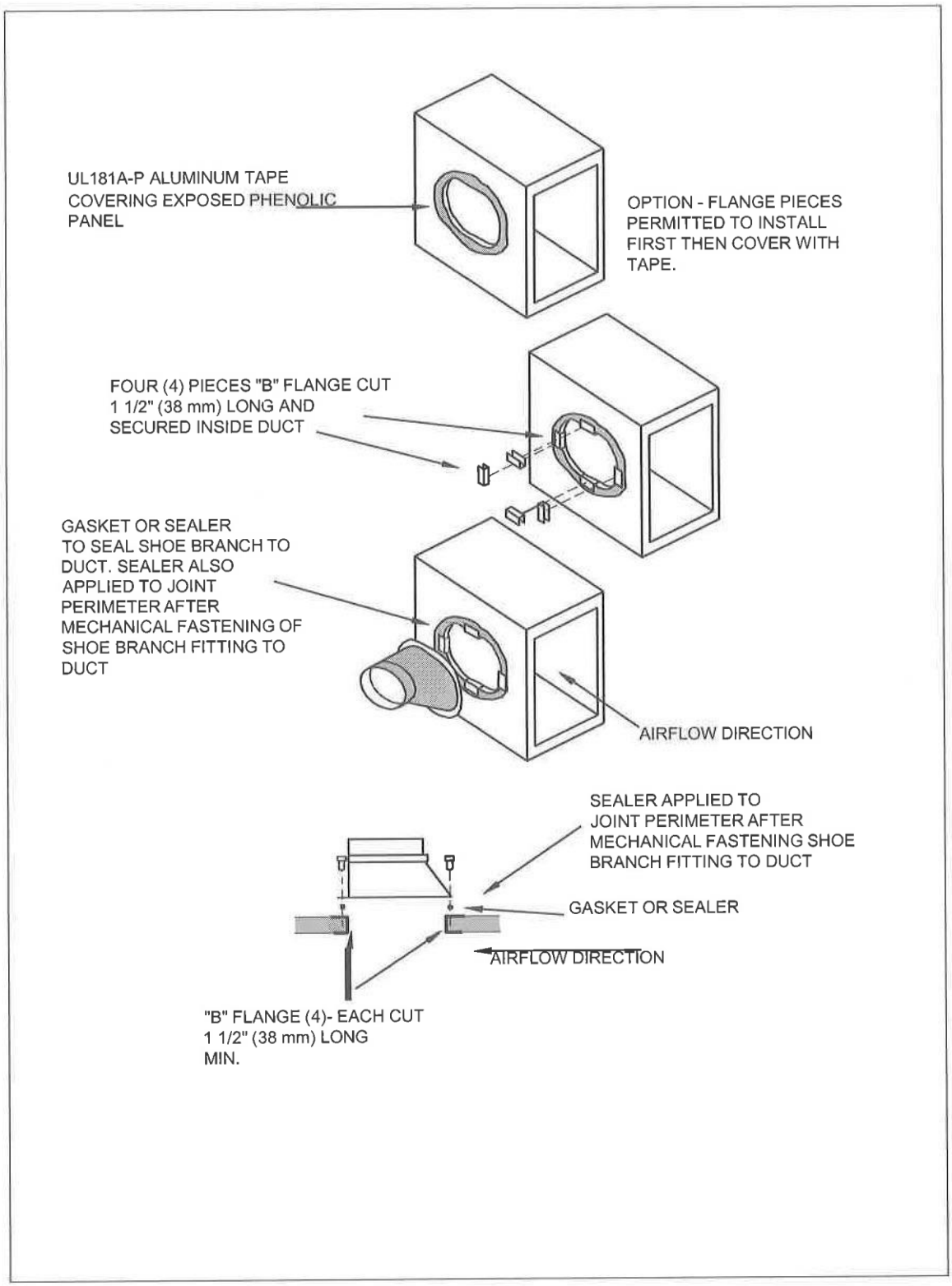


FIGURE 4-16 BRANCH CONNECTION - SHOE TYPE - MECHANICAL CONNECTION

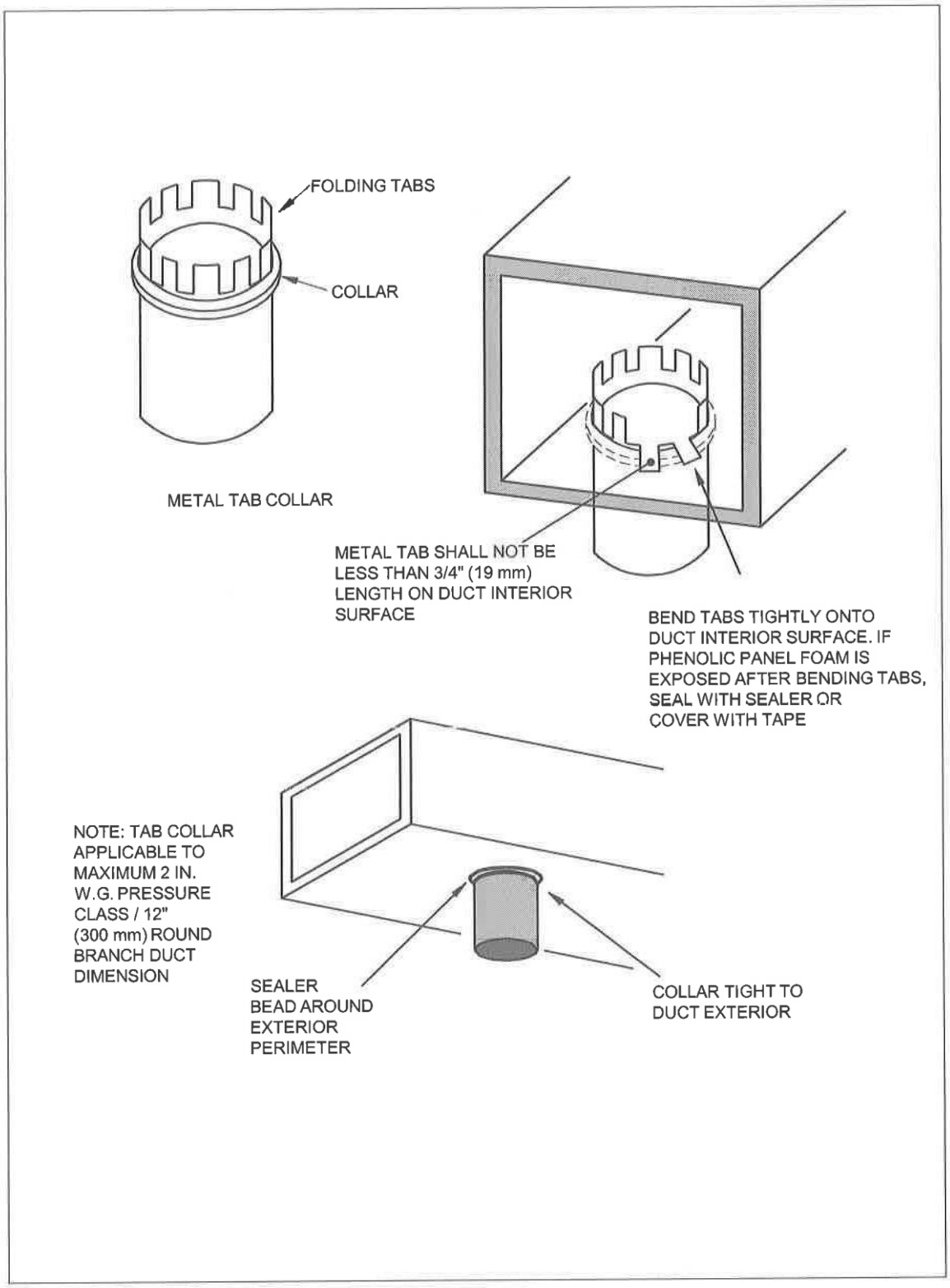


FIGURE 4-17 BRANCH CONNECTION - TAB COLLAR

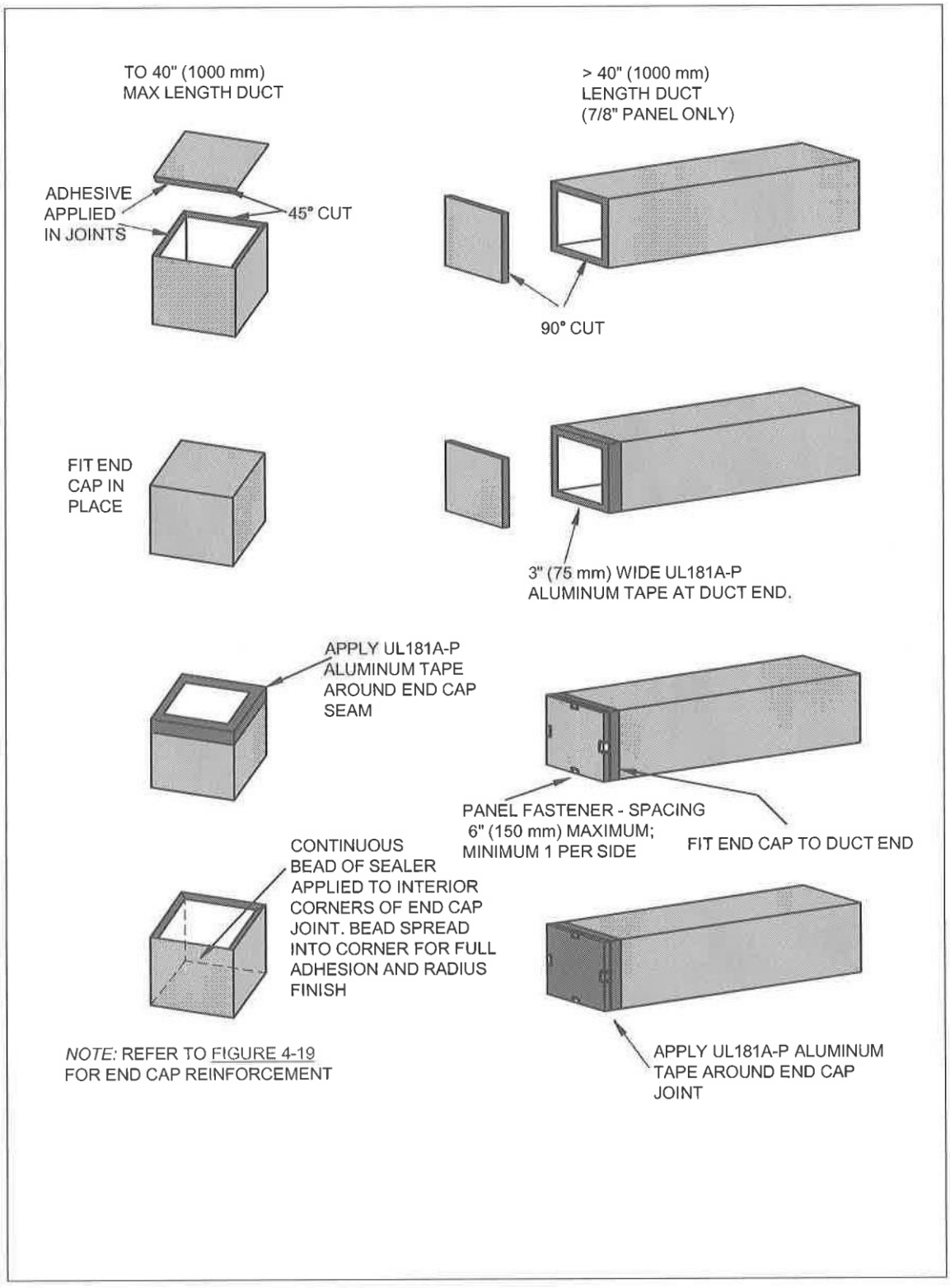


FIGURE 4-18 END CAP

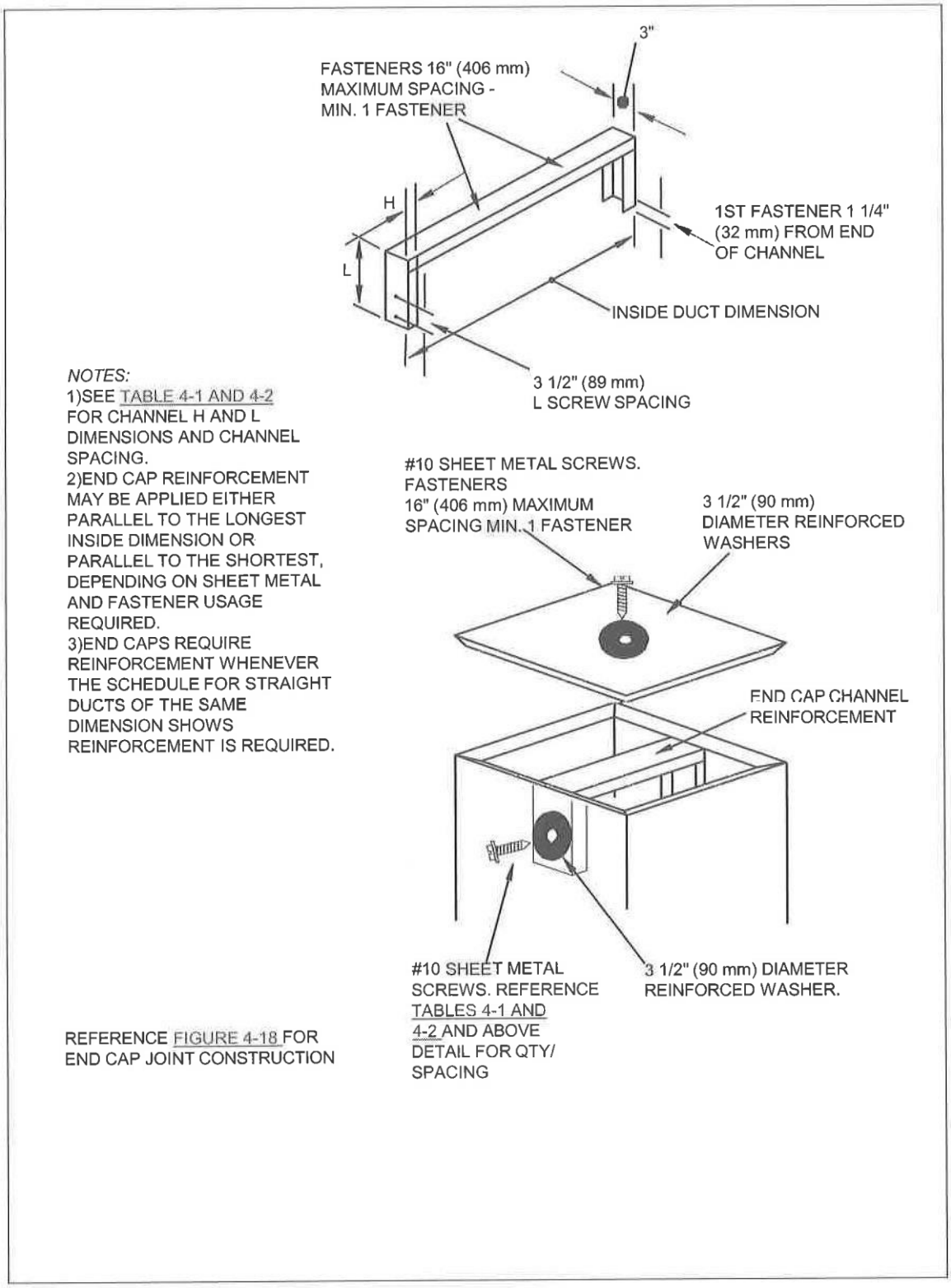


FIGURE 4-19 END CAP CHANNEL REINFORCEMENT

End Cap Channel Reinforcement						
Pressure Class in. w.g.	**Duct Dimension in.**	**Maximum Channel Spacing in.**	**Channel Gage**	**H Dimension in.**	**L Dimension in.**	**Fasteners Per Ea L Side**
.50	0 – 68	Not Required				
.50	> 68	68	18	1 1/4	13	4
1	0 – 36	Not Required				
1	> 36	36	22	1	7	2
2	0 – 28	Not Required				
2	> 28	28	22	1	10	3
3	0 – 20	Not Required				
3	> 20	20	22	1	7	2
4	0 – 20	Not Required				
4	> 20	20	22	1	10	3

Table 4-1 End Cap Channel System Reinforcement (I-P)

End Cap Channel Reinforcement (mm)						
Pressure Class Pa	**Duct Dimension mm**	**Maximum Channel Spacing mm**	**Channel Thickness mm**	**H Dimension mm**	**L Dimension mm**	**Fasteners Per Ea L Side**
125	0 – 1727	Not Required				
125	> 1727	1727	1.31	32	330	4
250	0 – 900	Not Required				
250	> 900	900	0.85	25	178	2
500	0 – 711	Not Required				
500	> 711	711	0.85	25	254	3
750	0 – 508	Not Required				
750	> 508	508	0.85	25	178	2
1000	0 – 508	Not Required				
1000	> 508	508	0.85	25	254	3

Table 4-2 End Cap Channel System Reinforcement (SI)

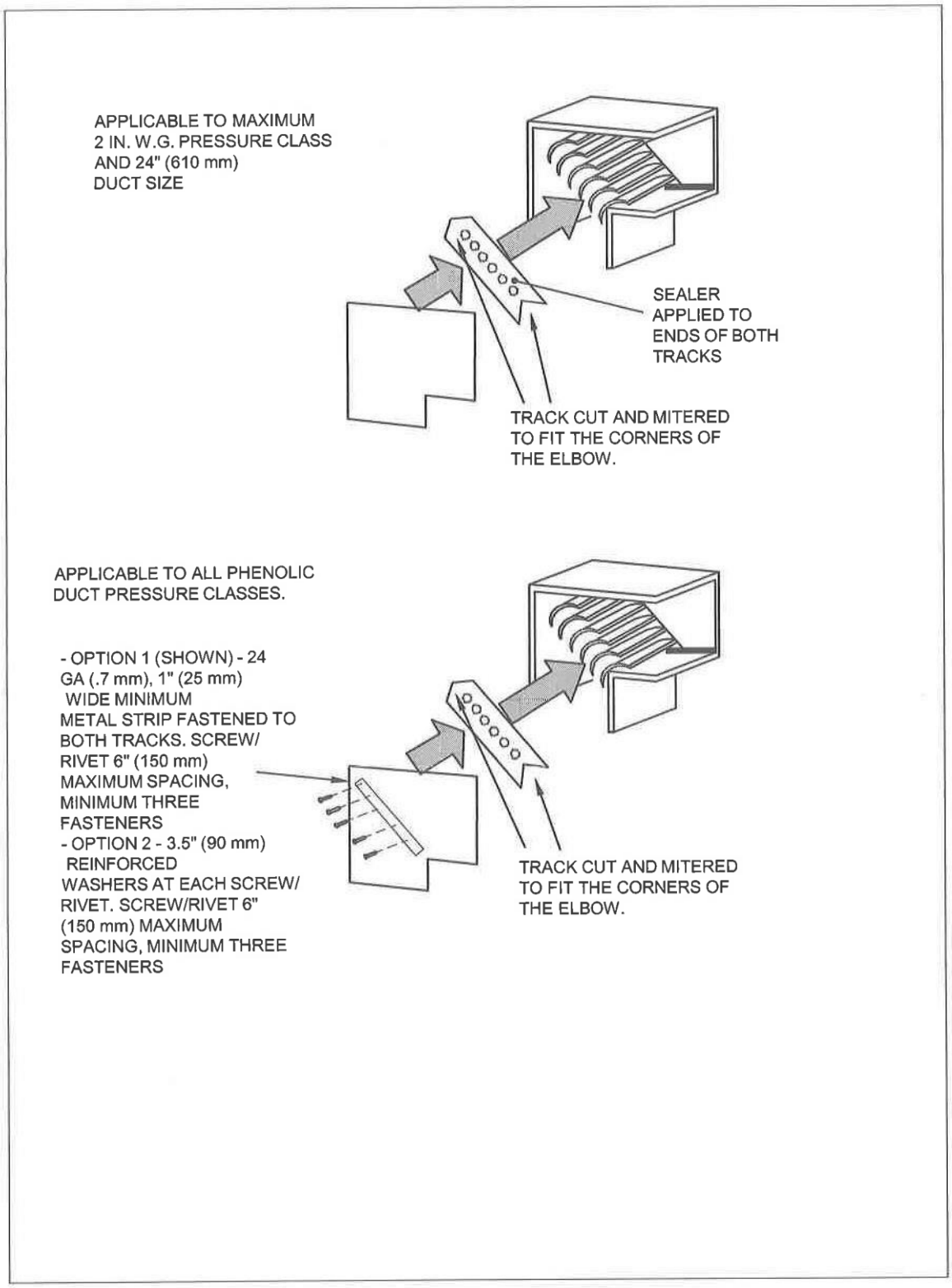


FIGURE 4-20 TURNING VANES

FITTINGS AND CONNECTIONS	FIGURE No.	Duct Dimension	Application Notes	in. w.g. / Pa Static				
				Positive or Negative				Pos.
				.50	1	2	3	4
				125	250	500	750	1000
Fittings – Adhesive In Longitudinal Seam(s) and Longitudinal Corners.	3-1, 4-1 - 4-18	80 in. (2000 mm) and Under		X	X	X	X	X
Fittings – Optional Panel Fasteners In Lieu Of Adhesive In Longitudinal Seams and Longitudinal Corners.	3-2, 4-1 - 4-18	80 in. (2000 mm) and Under	Panel Fasteners On Longitudinal Seams And Longitudinal Corners. Radius Fittings Panel Fasteners Spacing: 4" (102 mm) Throat; 10" (254 mm) Heel	X	X	X	X	X
Branch Connection 45^0 Tap – Flanged	4-13, 4-14	80 in. (2000 mm) and Under		X	X	X	X	X
Branch Connection 45^0 Tap – Non-Flanged	4-15	24 in. (600 mm) and Under		X	X	X	Not Permitted	
Shoe Branch, Mechanical Connection	4-16	All Sizes		X	X	X	X	X
Tab Collar	4-17	12 in. (300 mm) and Under		X	X	X	Not Permitted	
End Cap	4-18	80 in. (2000 mm) and Under	Refer To Figure 4-19 and Tables 4-1 and 4-2 For End Cap Reinforcement	X	X	X	X	X
Turning Vanes Without Mechanical Fasteners	4-20	24 in. (600 mm) and Under		X	X	X	Not Permitted	
Turning Vanes With Mechanical Fasteners	4-20	80 in. (2000 mm) and Under	External Mechanical Fasteners Required	X	X	X	X	X

LEGEND:

X Permitted

Note: For duct over 80 in. (2000 mm) consult with the phenolic panel manufacturer.

Table 4-3 Fittings and Connections Pressure Table

CHAPTER 3

REINFORCEMENT

5.1 PHENOLIC DUCT REINFORCEMENT

Duct reinforcement is required to ensure that the true rectangular cross section of the duct is maintained.

A. Reinforcement Requirements:

1. The ductwork may require reinforcement, check the following:

   a. Duct Size (both width and height)

   b. System Pressure inside ductwork.

   c. Transverse Joint Construction

B. Installation of Duct Reinforcement

1. Reinforcing bars, both positive and negative Pressure, any duct side

C. Areas where over pressure may exceed design pressure

1. Operating pressure shall not exceed the duct construction pressure class. The designer must specify duct system pressure relief procedures and precautions to protect and prevent duct systems from over pressurization.

D. Large Ductwork

1. For ductworks larger than those covered by the Schedule of duct reinforcement in this manual, consult with the panel manufacturer.

E. Tie Rod Reinforced Washers

1. Reinforced washers shall equal in area to 3.5 in. (90 mm) diameter minimum and be .04 in. (1 mm) thickness minimum. Specific to reinforcement, the PDCS requires washers to be used:

   A. Between tie rod push-on fasteners and phenolic panels

   B. Between tie rod bolts and nuts and phenolic panels

   C. Between phenolic panels and: rigid conduit (RC); electrical metallic tubing (EMT); aluminum tubing; or steel pipe.

F. Tie Rod Push On Fasteners

1. Push-on fastener for 13/32 in. (10 mm) aluminum reinforcement tube – When push-on fasteners are utilized, the push-on fastener shall be complete with a cap and be made of zinc plated steel 0.012 in. (0.305 mm) minimum thickness. The push-on fastener cap shall be made of electro plated steel and be minimum 0.3 in. (7.7 mm) deep. The fastener to be complete with 6 legs minimum designed to retain 13/32 in. (10 mm) tube diameter which is the diameter of the 13/32 in. (10 mm) aluminum reinforcement tube tie rod.

G. Aluminum Reinforcement Tube

1. 9/16 in. (14 mm) aluminum reinforcement tube – Shall be 9/16 in. (14 mm) outside diameter minimum and 7/16 in. (11 mm) inside diameter minimum and have a wall thickness of 1/16 in. (1.5 mm) minimum

2. 13/32 in. (10 mm) aluminum reinforcement tube – Shall be 13/32 in. (10 mm) outside diameter minimum and 1/4 in. (6 mm) inside diameter minimum and have a wall thickness of 5/64 in. (2 mm) minimum

H. Tie Rod Installations

1. The term "tie rod" applies to a variety of galvanized steel shapes (i.e., rod, pipe and tube).

2. Internal ties shall be one of the methods shown in Figure 5-1 or 5-2. The restraining member and its connections shall be capable of sustaining a load equal to 100 percent of the duct construction pressure class load applied as 5.2 pounds per square foot per inch of water gage (101.63 kg per square meter per kPa) over an area equal to the width of the duct times the reinforcement interval. When more than one tie rod is used at a cross-section of the duct, the design load may be proportionately reduced.

3. For tie rod quantity and placement, reference Tables 5-1 through 5-12 and Figures 5-3 and 5-4.

4. For positive pressure tie rod selection refer to Tables A, B, C and D within Table 5-13 for tie rod selection.

   Steel pipe is not indicated within Table 5-13 due to other options considered more economical. Specifically, steel piping is not prohibited.

5. For negative pressure tie rod selection refer to Tables A, B and C within Table 5-14 and Tables D and E within Table 5-15 for tie rod selection

6. Tie rods shall be limited to duct velocities up to 2500 fpm (12.7 m/s) maximum.

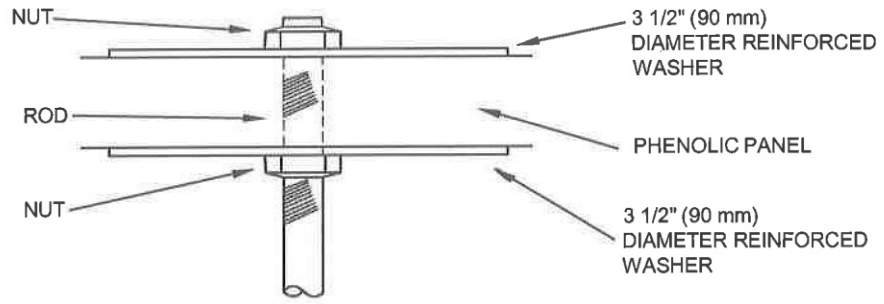
7. Holes made in the duct wall for tie rod passage shall be of minimum size and shall be sealed with sealer as may be required.

8. Tie Rod Material:

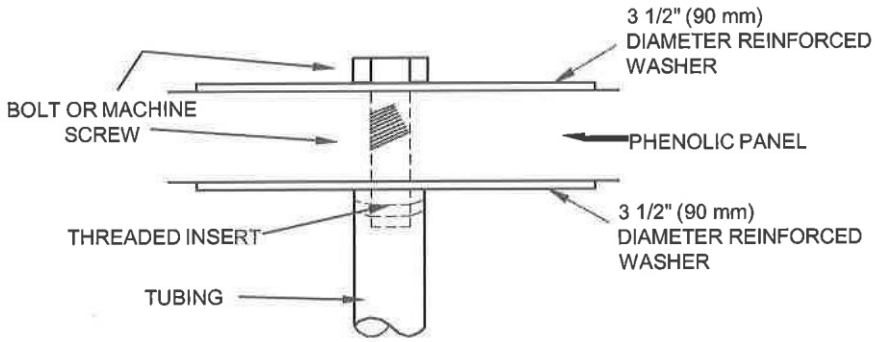
   A. All internal ties, whether of rod, tube or pipe shall be of material having corrosion resistance.

9. Ties rods shall be attached so that they will not loosen or detach at 150 percent of the selected duct pressure class. For positive pressure, threaded inserts placed in pipes and tubes shall be rated at 200 percent of the load.

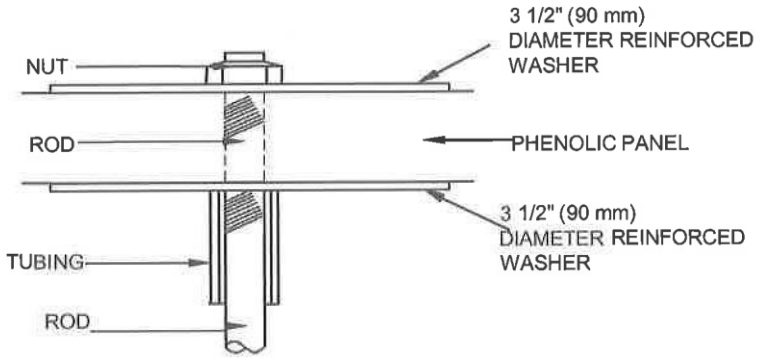
10. When ties occur in two directions in the same vicinity, they shall either be prevented from contacting or be permanently fastened together.



ROD WITH INTERNAL AND EXTERNAL NUTS

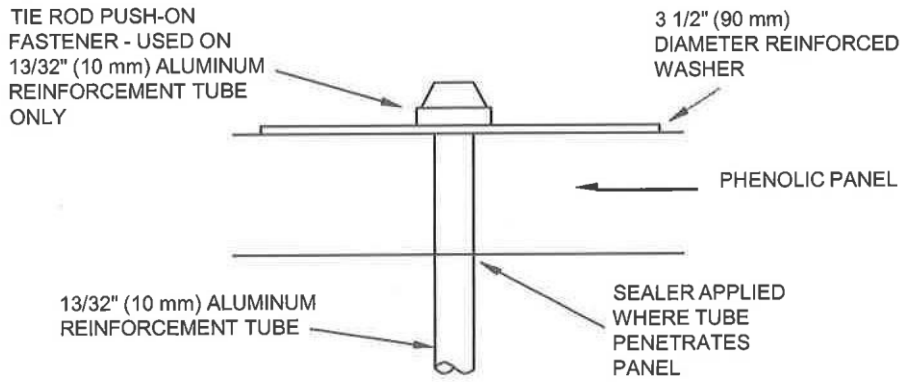


TUBING OR CONDUIT WITH THREADED INSERTS

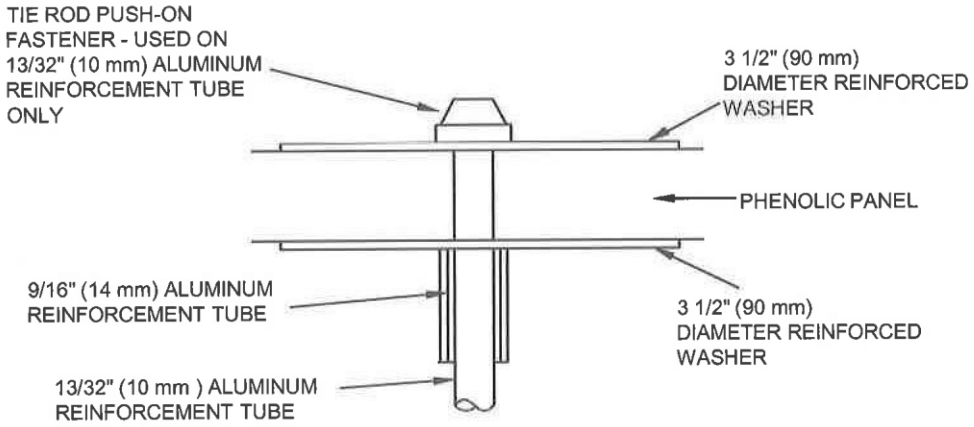


TUBING ENCASED ROD

FIGURE 5-1 TIE ROD ATTACHMENTS



ALUMINUM REINFORCEMENT TUBE- POSITIVE PRESSURE ONLY



ALUMINUM REINFORCEMENT - TUBE ENCASED TUBE

FIGURE 5-2 TIE RODATTACHMENTS

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required			Not Designed	
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.			1 @ Joint		
25 – 28	154 3/4 in.		1 @ Joint	1 @ Joint		
29 – 32	154 3/4 in.	1 @ Joint	1 @ Joint	1 @ 36 in.		
33 – 36	154 3/4 in.	1 @ Joint	1 @ Joint	1 @ 36 in.		
37 – 40	154 3/4 in.	1 @ Joint	1 @ 36 in.	1 @ 36 in.		
41 – 44	154 3/4 in.	1 @ Joint	1 @ 36 in.	1 @ 36 in.		
45 – 48	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
49 – 52	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
53 – 56	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
57 – 60	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
61 – 64	47 1/4 in.					
65 – 68	47 1/4 in.					
69 – 72	47 1/4 in.					
73 – 76	47 1/4 in.					
77 – 80	47 1/4 in.					
Over 80"						

LEGEND:

1 @ Joint	Tie Rod Placed Maximum 12 in. From Each Joint
1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.; First and Last Ties Rods Maximum 12 in. From Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.

Table 5-1 Duct Reinforcement Table (I-P) 7/8 IN. Panel Non-Flanged Transverse Joints (FIGURE 3-3)

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
		125	250	500	750	1000
100 – 200	3930	Not Required				
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930			1 @ Joint		
601 – 700	3930		1 @ Joint	1 @ Joint		
701 – 800	3930	1 @ Joint	1 @ Joint	1 @ 900 mm		
801 – 900	3930	1 @ Joint	1 @ Joint	1 @ 900 mm		
901 – 1000	3930	1 @ Joint	1 @ 900 mm	1 @ 900 mm		
1001 – 1100	3930	1 @ Joint	1 @ 900 mm	1 @ 900 mm		
1101 – 1200	1200	1 @ 600 mm	1 @ 600 mm			
1201 – 1300	1200	1 @ 600 mm	1 @ 600 mm			
1301 – 1400	1200	1 @ 600 mm	1 @ 600 mm			
1401 – 1500	1200	1 @ 600 mm	1 @ 600 mm		Not Designed	
1501 – 1600	1200					
1601 – 1700	1200					
1701 – 1800	1200					
1801 – 1900	1200					
1901 – 2000	1200					
Over 2000						

LEGEND:

1 @ Joint	Tie Rod Placed Maximum 300 mm From Each Joint
1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm; First and Last Ties Rods Maximum 300 mm From Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm

Table 5-2 Duct Reinforcement Table (SI) 22 MM Panel Non-Flanged Transverse Joints (FIGURE 3-3)

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required				
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
25 – 28	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
29 – 32	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
33 – 36	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	2 @ 24 in.
37 – 40	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 24 in.	2 @ 24 in.
41 – 44	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 24 in.	2 @ 24 in.
45 – 48	47 1/4 in.			1 @ 24 in.	1 @ 24 in.	2 @ 24 in.
49 – 52	47 1/4 in.			1 @ 24 in.	2 @ 24 in.	2 @ 24 in.
53 – 56	47 1/4 in.		1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.
57 – 60	47 1/4 in.		1 Centered	1 @ 24 in.	2 @ 24 in.	3 @ 24 in.
61 – 64	47 1/4 in.		1 Centered	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
65 – 68	47 1/4 in.		1 @ 24 in.	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
69 – 72	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
73 – 76	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	3 @ 24 in.	3 @ 24 in.
77 – 80	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	3 @ 24 in.	3 @ 24 in.
Over 80"	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.; First and Last Tie Rods Maximum 18 in. From Joints
1 Centered	One Tie Rod Centered Equal Distance Between Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.; First and Last Ties Rods Maximum 12 in. From Joints
2 @ 24 in.	Two Tie Rods Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints
3 @ 24 in.	Three Tie Rods Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints

Table 5-3 Duct Reinforcement Table (I-P) 7/8 IN. Panel "A" Flange (FIGURE 3-7) and Optional "B/C" Flange (FIGURE 3-8) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
	125	250	500	750	1000	
100 – 200	3930	Not Required				
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930				1 @ 900 mm	1 @ 900 mm
601 – 700	3930				1 @ 900 mm	1 @ 900 mm
701 – 800	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
801 – 900	3930			1 @ 900 mm	1 @ 900 mm	2 @ 600 mm
901 – 1000	3930		1 @ 900 mm	1 @ 900 mm	1 @ 600 mm	2 @ 600 mm
1001 – 1100	3930		1 @ 900 mm	1 @ 900 mm	1 @ 600 mm	2 @ 600 mm
1101 – 1200	1200			1 @ 600 mm	1 @ 600 mm	2 @ 600 mm
1201 – 1300	1200			1 @ 600 mm	2 @ 600 mm	2 @ 600 mm
1301 – 1400	1200		1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm
1401 – 1500	1200		1 Centered	1 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1501 – 1600	1200		1 Centered	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1601 – 1700	1200		1 @ 600 mm	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1701 – 1800	1200	1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1801 – 1900	1200	1 Centered	1 @ 600 mm	2 @ 600 mm	3 @ 600 mm	3 @ 600 mm
1901 – 2000	1200	1 Centered	1 @ 600 mm	2 @ 600 mm	3 @ 600 mm	3 @ 600 mm
Over 2000	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm; First and Last Tie Rods Maximum 450 mm From Joints
1 Centered	One Tie Rod Centered Equal Distance Between Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm; First and Last Ties Rods Maximum 300 mm From Joints
2 @ 600 mm	Two Tie Rods Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints
3 @ 600 mm	Three Tie Rods Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints

Table 5-4 Duct Reinforcement Table (SI) 22 MM Panel "A" Flange (FIGURE 3-7) and Optional "B/C" Flange (FIGURE 3-8) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required				
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
25 – 28	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
29 – 32	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
33 – 36	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	2 @ 24 in.
37 – 40	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 24 in.	2 @ 24 in.
41 – 44	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 24 in.	2 @ 24 in.
45 – 48	47 1/4 in.			1 Centered	2 Centered	2 @ 24 in.
49 – 52	47 1/4 in.			1 Centered	2 Centered	2 @ 24 in.
53 – 56	47 1/4 in.			1 Centered	2 @ 24 in.	2 @ 24 in.
57 – 60	47 1/4 in.			1 Centered	2 @ 24 in.	3 @ 24 in.
61 – 64	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
65 – 68	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
69 – 72	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
73 – 76	47 1/4 in.		1 Centered	2 Centered	3 @ 24 in.	3 @ 24 in.
77 – 80	47 1/4 in.		1 Centered	2 Centered	3 @ 24 in.	3 @ 24 in.
Over 80"	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.
1 Centered	One Tie Rod Centered Equal Distance Between Joints
2 Centered	Two Tie Rods In Row Centered Equal Distance Between Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.; First and Last Ties Rods Maximum 12 in. From Joints
2 @ 24 in.	Two Tie Rods In Row Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints
3 @ 24 in.	Three Tie Rods In Row Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints

Table 5-5 Duct Reinforcement Table (I-P) 7/8 IN. Panel 4 Bolt Flange (FIGURE 3-9) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
		125	250	500	750	1000
100 – 200	3930	Not Required				
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930				1 @ 900 mm	1 @ 900 mm
601 – 700	3930				1 @ 900 mm	1 @ 900 mm
701 – 800	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
801 – 900	3930			1 @ 900 mm	1 @ 900 mm	2 @ 600 mm
901 – 1000	3930		1 @ 900 mm	1 @ 900 mm	1 @ 600 mm	2 @ 600 mm
1001 – 1100	3930		1 @ 900 mm	1 @ 900 mm	1 @ 600 mm	2 @ 600 mm
1101 – 1200	1200			1 Centered	2 Centered	2 @ 600 mm
1201 – 1300	1200			1 Centered	2 Centered	2 @ 600 mm
1301 – 1400	1200			1 Centered	2 @ 600 mm	2 @ 600 mm
1401 – 1500	1200			1 Centered	2 @ 600 mm	3 @ 600 mm
1501 – 1600	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
1601 – 1700	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
1701 – 1800	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
1801 – 1900	1200		1 Centered	2 Centered	3 @ 600 mm	3 @ 600 mm
1901 – 2000	1200		1 Centered	2 Centered	3 @ 600 mm	3 @ 600 mm
Over 2000	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm
1 Centered	One Tie Rod Centered Equal Distance Between Joints
2 Centered	Two Tie Rods In Row Centered Equal Distance Between Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm; First and Last Ties Rods Maximum 300 mm From Joints
2 @ 600 mm	Two Tie Rods In Row Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints
3 @ 600 mm	Three Tie Rods In Row Longitudinal Spacing Maximum 600 mm; First and Last Row of Tie Rods Maximum 300 mm From Joints

Table 5-6 Duct Reinforcement Table (SI) 22 MM Panel 4 Bolt Flange (FIGURE 3-9) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required			Not Designed	
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.					
25 – 28	154 3/4 in.			1 @ Joint		
29 – 32	154 3/4 in.		1 @ Joint	1 @ 36 in.		
33 – 36	154 3/4 in.	NR	1 @ Joint	1 @ 36 in.		
37 – 40	154 3/4 in.	1 @ Joint	1 @ 36 in.	1 @ 36 in.		
41 – 44	154 3/4 in.	1 @ Joint	1 @ 36 in.	1 @ 36 in.		
45 – 48	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
49 – 52	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
53 – 56	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
57 – 60	47 1/4 in.	1 @ 24 in.	1 @ 24 in.			
61 – 64	47 1/4 in.					
65 – 68	47 1/4 in.					
69 – 72	47 1/4 in.					
73 – 76	47 1/4 in.					
77 – 80	47 1/4 in.					
Over 80"						

LEGEND:

1 @ Joint	Tie Rod Placed Maximum 12 in. From Each Joint
1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.; First and Last Ties Rods Maximum 12 in. From Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.; First and Last Ties Rods Maximum 12 in. From Joints

Table 5-7 Duct Reinforcement Table (I-P) 1 3/16 IN. Panel Non-Flanged Transverse Joints (FIGURE 3-3)

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
		125	250	500	750	1000
100 – 200	3930	Not Required			Not Designed	
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930					
601 – 700	3930			1 @ Joint		
701 – 800	3930		1 @ Joint	1 @ 900 mm		
801 – 900	3930		1 @ Joint	1 @ 900 mm		
901 – 1000	3930	1 @ Joint	1 @ 900 mm	1 @ 900 mm		
1001 – 1100	3930	1 @ Joint	1 @ 900 mm	1 @ 900 mm		
1101 – 1200	1200	1 @ 600 mm	1 @ 600 mm			
1201 – 1300	1200	1 @ 600 mm	1 @ 600 mm			
1301 – 1400	1200	1 @ 600 mm	1 @ 600 mm			
1401 – 1500	1200	1 @ 600 mm	1 @ 600 mm			
1501 – 1600	1200					
1601 – 1700	1200					
1701 – 1800	1200					
1801 – 1900	1200					
1901 – 2000	1200					
Over 2000						

LEGEND:

1 @ Joint	Tie Rod Placed Maximum 300 mm From Each Joint
1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm; First and Last Ties Rods Maximum 300 mm From Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm; First and Last Ties Rods Maximum 300 mm From Joints

Table 5-8 Duct Reinforcement Table (SI) 30 MM Panel Non-Flanged Transverse Joints (FIGURE 3-3)

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required				
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
25 – 28	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
29 – 32	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
33 – 36	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
37 – 40	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
41 – 44	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
45 – 48	47 1/4 in.			1 Centered	1 @ 24 in.	2 @ 24 in.
49 – 52	47 1/4 in.			1 Centered	1 @ 24 in.	2 @ 24 in.
53 – 56	47 1/4 in.		1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.
57 – 60	47 1/4 in.		1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.
61 – 64	47 1/4 in.		1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.
65 – 68	47 1/4 in.		1 Centered	2 @ 24 in.	2 @ 24 in.	2 @ 24 in.
69 – 72	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
73 – 76	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
77 – 80	47 1/4 in.	1 Centered	1 @ 24 in.	2 @ 24 in.	2 @ 24 in.	3 @ 24 in.
Over 80"	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.; First and Last Tie Rods Maximum 18 in. From Joints
1 Centered	One Tie Rod Centered Equal Distance Between Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.; First and Last Ties Rods Maximum 12 in. From Joints
2 @ 24 in.	Two Tie Rods In Row Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints
3 @ 24 in.	Three Tie Rods In Row Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints

Table 5-9 Duct Reinforcement Table (I-P) 1 3/16 IN. Panel "A" Flange (FIGURE 3-7) and Optional "B/C" Flange (FIGURE 3-8) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
		125	250	500	750	1000
100 – 200	3930	Not Required				
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930				1 @ 900 mm	1 @ 900 mm
601 – 700	3930				1 @ 900 mm	1 @ 900 mm
701 – 800	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
801 – 900	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
901 – 1000	3930		1 @ 900 mm	1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
1001 – 1100	3930		1 @ 900 mm	1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
1101 – 1200	1200			1 Centered	1 @ 600 mm	2 @ 600 mm
1201 – 1300	1200			1 Centered	2 @ 600 mm	2 @ 600 mm
1301 – 1400	1200		1 Centered	1 Centered	2 @ 600 mm	2 @ 600 mm
1401 – 1500	1200		1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm
1501 – 1600	1200		1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm
1601 – 1700	1200		1 Centered	2 @ 600 mm	2 @ 600 mm	2 @ 600 mm
1701 – 1800	1200		1 Centered	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1801 – 1900	1200	1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
1901 – 2000	1200	1 Centered	1 @ 600 mm	2 @ 600 mm	2 @ 600 mm	3 @ 600 mm
Over 2000	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm; First and Last Tie Rods Maximum 450 mm From Joints
1 Centered	One Tie Rod Centered Equal Distance Between Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm; First and Last Ties Rods Maximum 300 mm From Joints
2 @ 600 mm	Two Tie Rods In Row Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints
3 @ 600 mm	Three Tie Rods In Row Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints

Table 5-10 Duct Reinforcement Table (SI) 30 MM Panel "A" Flange (FIGURE 3-7) and Optional "B/C" Flange (FIGURE 3-8) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension Inches	Max. Duct Segment Length	in. w.g. Static Pos. or Neg.				in. w.g. Static Pos. Only
		.50	1	2	3	4
4 – 8	154 3/4 in.	Not Required				
9 – 12	154 3/4 in.					
13 – 16	154 3/4 in.					
17 – 20	154 3/4 in.					
21 – 24	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
25 – 28	154 3/4 in.				1 @ 36 in.	1 @ 36 in.
29 – 32	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
33 – 36	154 3/4 in.			1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
37 – 40	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
41 – 44	154 3/4 in.		1 @ 36 in.	1 @ 36 in.	1 @ 36 in.	1 @ 24 in.
45 – 48	47 1/4 in.			1 Centered	1 Centered	2 Centered
49 – 52	47 1/4 in.			1 Centered	1 Centered	2 @ 24 in.
53 – 56	47 1/4 in.			1 Centered	2 Centered	2 @ 24 in.
57 – 60	47 1/4 in.			1 Centered	2 Centered	2 @ 24 in.
61 – 64	47 1/4 in.		1 Centered	2 Centered	2 Centered	2 @ 24 in.
65 – 68	47 1/4 in.		1 Centered	2 Centered	2 Centered	2 @ 24 in.
69 – 72	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
73 – 76	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
77 – 80	47 1/4 in.		1 Centered	2 Centered	2 @ 24 in.	3 @ 24 in.
Over 80"	Consult With The Phenolic Panel Manufacturer					

LEGEND:

1 @ 36 in.	Tie Rod Longitudinal Spacing Maximum 36 in.
1 Centered	One Tie Rod Centered Equal Distance Between Joints
2 Centered	Two Tie Rods In Row Centered Equal Distance Between Joints
1 @ 24 in.	Tie Rod Longitudinal Spacing Maximum 24 in.; First and Last Ties Rods Maximum 12 in. From Joints
2 @ 24 in.	Two Tie Rods In Row Longitudinal Spacing Maximum 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints
3 @ 24 in.	Three Tie Rods In Row Longitudinal Spacing 24 in.; First and Last Row of Tie Rods Maximum 12 in. From Joints

Table 5-11 Duct Reinforcement Table (I-P) 1 3/16 IN. Panel 4 Bolt Flange (FIGURE 3-9) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Duct Dimension mm	Max. Duct Segment Length mm	Pa. Static Pos. or Neg.				Pa. Static Pos. Only
		125	250	500	750	1000
100 – 200	3930	Not Required				
201 – 300	3930					
301 – 400	3930					
401 – 500	3930					
501 – 600	3930				1 @ 900 mm	1 @ 900 mm
601 – 700	3930				1 @ 900 mm	1 @ 900 mm
701 – 800	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
801 – 900	3930			1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
901 – 1000	3930		1 @ 900 mm	1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
1001 – 1100	3930		1 @ 900 mm	1 @ 900 mm	1 @ 900 mm	1 @ 600 mm
1101 – 1200	1200			1 Centered	1 Centered	2 Centered
1201 – 1300	1200			1 Centered	1 Centered	2 @ 600 mm
1301 – 1400	1200			1 Centered	2 Centered	2 @ 600 mm
1401 – 1500	1200			1 Centered	2 Centered	2 @ 600 mm
1501 – 1600	1200		1 Centered	2 Centered	2 Centered	2 @ 600 mm
1601 – 1700	1200		1 Centered	2 Centered	2 Centered	2 @ 600 mm
1701 – 1800	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
1801 – 1900	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
1901 – 2000	1200		1 Centered	2 Centered	2 @ 600 mm	3 @ 600 mm
Over 2000	Consult With Phenolic Panel Manufacturer					

LEGEND:

1 @ 900 mm	Tie Rod Longitudinal Spacing Maximum 900 mm
1 Centered	One Tie Rod Centered Equal Distance Between Joints
2 Centered	Two Tie Rods In Row Centered Equal Distance Between Joints
1 @ 600 mm	Tie Rod Longitudinal Spacing Maximum 600 mm; First and Last Tie Rods Maximum 300 mm From Joints
2 @ 600 mm	Two Tie Rods In Row Longitudinal Spacing Maximum 600 mm.; First and Last Row of Tie Rods Maximum 300 mm From Joints
3 @ 600 mm	Three Tie Rods In Row Longitudinal Spacing Maximum 600 mm; First and Last Row of Tie Rods Maximum 300 mm From Joints

Table 5-12 Duct Reinforcement Table (SI) 30 MM Panel 4 Bolt Flange (FIGURE 3-9) Transverse Joints

Note: Reinforcement Requirements Applicable To Both Duct Width And Height

Table A – Threaded Rod Maximum Length			
Rod Spec. in.	**Max. Length in.**	**Rod Spec mm.**	**Max. Length mm**
1/4 in. – 20	36	6.4 mm – .078	900
5/16 in. – 18	36	7.9 mm – .071	900
3/8 in. – 16	84	9.5 mm – 0.63	2134

Rod specification is diameter and threads per inch/mm.

Table B – Rigid Conduit (RC) Maximum Length			
RC Size in.	**Max. Length in.**	**RC Size mm**	**Max. Length mm**
1/2 in.	84	12.7 mm	2134
3/4 in.	84	19.1 mm	2134

Table C – Electrical Metallic Tubing (EMT) Maximum Length			
EMT Size in.	**Max. Length in.**	**EMT Size mm**	**Max. Length mm**
1/2 in.	84	12.7 mm	2134
3/4 in.	84	19.1 mm	2134

Table D – 13/32 in. (10 mm) OD Aluminum Reinforcement Tube Maximum Length			
Tube Size in.	**Max. Length in.**	**Tube Size mm**	**Max. Length mm**
13/32 in	84	10 mm	2134

Table 5-13 Tie Rod Selection Positive Pressure

Note: For Duct Over 80 in. (2000 mm) Consult the Phenolic Panel manufacturer

Table A – Threaded Rod Maximum Length			
Rod Spec. in.	**Max. Length in.**	**Rod Spec mm.**	**Max. Length mm**
5/16 in. – 18	12	7.9 mm – .071	305
3/8 in. – 16	12	9.5 mm – 0.63	305
1/2 in. – 12	18	12.7 mm – 0.47	457
5/8 in. – 11	24	15.9 mm – 0.43	610
3/4 in. – 10	24	19.1 mm – 0.39	610
7/8 in. – 9	36	22.2 mm – 0.35	914
1 in. – 8	36	25 mm – 0.31	1066

Rod specification is diameter and threads per inch/mm.

Table B – Rigid Conduit (RC) Maximum Length			
RC Size in.	Max. Length in.	RC Size mm	Max. Length mm
1/2 in.	52	12.7 mm	1320
3/4 in.	66	19.1 mm	1676
1 in.	84	25 mm	2134

Table C – Electrical Metallic Tubing (EMT) Maximum Length			
EMT Size in.	Max. Length in.	EMT Size mm	Max. Length mm
1/2 in.	46	12.7 mm	1168
3/4 in.	62	19.1 mm	1575
1 in.	74	25 mm	1880
1 1/4 in.	102	31.8 mm	2591

Table 5-14 Tie Rod Selection Negative Pressure

Note: For Duct Over 80 in. (2000 mm) Consult the Phenolic Panel manufacturer

The Maximum Lengths Indicated Above Are Established to Limit The Compression Stress to That Associated With a Maximum Radius of Gyration Ratio to 200 L/r_g

Table D – Steel Pipe Maximum Length			
Pipe Size in.	**Max. Length in.**	**Pipe Size mm**	**Max. Length mm**
1/4 in.	33	6.4 mm	838
3/8 in.	42	9.5 mm	1067
1/2 in.	52	12.7 mm	1321
3/4 in.	67	19.1 mm	1702
1 in.	84	25 mm	2134

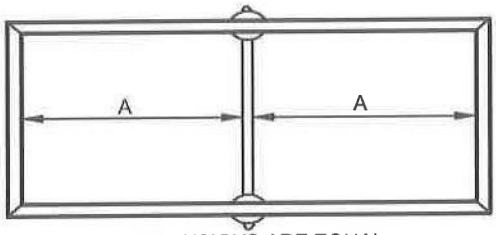
Galvanized steel pipe is of ASTM A53, A106, or A120 grade. Ends are considered pinned.

Table E – 9/16 in. (14 mm) OD Aluminum Reinforcement Tube Maximum Length			
Tube Size in.	**Max. Length in.**	**Tube Size mm**	**Max. Length mm**
9/16 in.	36	14 mm	914

Table 5-15 Tie Rod Selection Negative Pressure

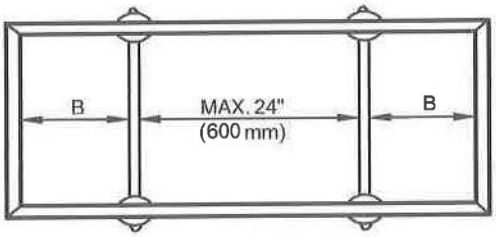
Note: For Duct Over 80 in. (2000 mm) Consult the Phenolic Panel manufacturer

The Maximum Lengths Indicated Above Are Established to Limit The Compression Stress to That Associated With a Maximum Radius of Gyration Ratio to 200 L/r_g



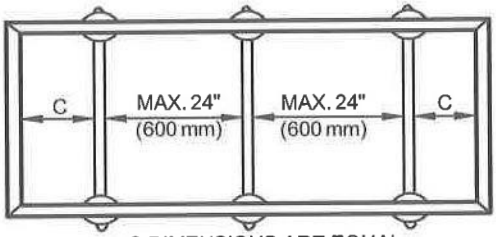
A DIMENSIONS ARE EQUAL

TYPICAL SPACING FOR 1 TIE ROD



B DIMENSIONS ARE EQUAL

TYPICAL SPACING FOR ROW OF 2 TIE RODS



C DIMENSIONS ARE EQUAL

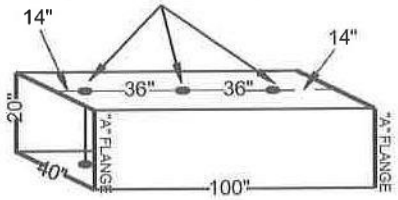
TYPICAL SPACING FOR ROW OF 3 TIE RODS

FIGURE 5-3 TIE ROD CROSS-SECTION SPACING

EXAMPLE 1: 7/8" (22 mm), PHENOLIC PANEL
PRESSURE CLASS: 1 IN. W.G. (250 PA)
DUCT SIZE: 40" (1016 mm) X 20" (508 mm)
DUCT SECTION LENGTH: 100" (2500 mm)

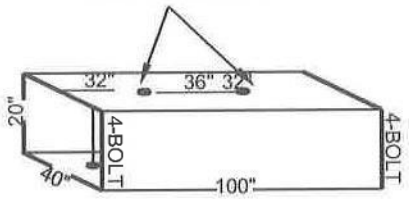
14" = 355 mm
18" = 457 mm
36" = 914 mm

REINFORCEMENTS



7/8" (22 mm) PANEL WITH "A" FLANGE
(SEE TABLE 5-3):
SIDE 40": 1@36", TIE ROD MAX 18" FROM JOINT
SIDE 20": NO REINFORCEMENT

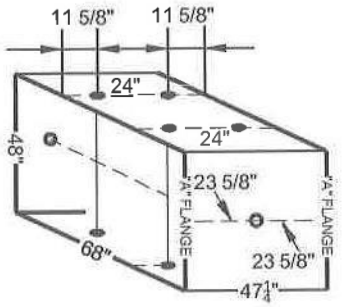
REINFORCEMENTS



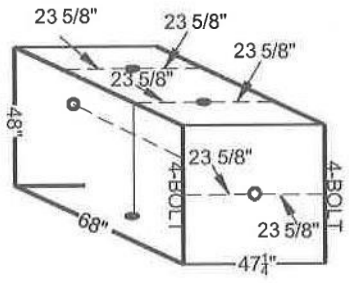
7/8" (22 mm) PANEL WITH 4-BOLT FLANGE
(SEE TABLE 5-5):
SIDE 40": 1@36", TIE ROD MAX 36" FROM JOINT
SIDE 20": NO REINFORCEMENT

EXAMPLE 2: 1 3/16" (30 mm), PHENOLIC PANEL
PRESSURE: 2" W.G. (500 PA)
DUCT SIZE: 68" (1727 mm) X 48" (1219 mm)
DUCT SECTION LENGTH: 47 1/4" (1200 mm)

11 5/8 " = 295 mm
23 5/8 " = 600 mm
24" = 610 mm



1 3/16" (30 mm) PANEL WITH "A" FLANGE AND
DRIVE CLEAT JOINT (SEE TABLE 5-9):
SIDE 68": 2@24", TIE ROD MAX 12" FROM JOINT
SIDE 48": 1 CENTERED



1 3/16" (30 mm) PANEL WITH 4-BOLT
FLANGE (SEE TABLE 5-11):
SIDE 68": 2 CENTERED
SIDE 48": 1 CENTERED

FIGURE 5-4 DUCT REINFORCEMENT EXAMPLES

CHAPTER 4

HANGERS AND SUPPORTS

6.1 HANGING AND SUPPORTING SYSTEMS

6.1.1 Requirements

Rectangular Phenolic ducts shall be installed with support systems indicated. They shall be installed as required to maintain alignment. Horizontal ducts shall have a support within 2 ft. (0.61 m) of each elbow and within 4 ft. (1.2 m) of each branch intersection. Upper attachments to structures shall have an allowable load not less than one–fourth of the failure (proof test) load but are not limited to the specific methods shown here.

2. COMMENTARY

The duct hanging system is composed of three elements, the upper attachment to the building, the hanger itself, and the lower attachment to the duct. The manufacturer's load ratings and application data should be followed for all devices and materials.

1. Concrete Inserts

Concrete inserts must be installed before the concrete is poured. They are used primarily where: A) the duct layout is simple and there is enough lead time to determine accurate placement; B) BIM efforts facilitate exacting hanger locations. The simplest insert is a piece of bent flat bar. Manufactured inserts are available individually or in long lengths; the latter are generally used where many hangers will be installed in a small area, or where individual inserts cannot be precisely located at the time of placing the concrete.

2. Concrete Fasteners

Concrete fasteners are installed after the concrete has been poured and the forms have been removed. There are several variations of powder–actuated fasteners, which are installed with powder–actuated tools and booster cartridges. Gas driven fasteners are also used for upper attachments. Powder–actuated or gas driven fasteners should be used within the manufacturer's published application limits. Load capacities are based on tests in representative base materials in accordance with ASTM E1190.

3. Structural Steel Fasteners

Several types of beam clamps are available. Some should be used with a retaining clip. Powder–actuated and gas driven fasteners or threaded studs may also be used on steel. Welded studs may be installed using special welding equipment.

6.2.4 Cellular Metal Deck

Buildings can be constructed with a cellular steel deck that carries the electrical and communication systems and is covered with concrete fill. The wiring in the cells and the concrete above the deck preclude the use of fasteners, such as sheet metal screws, that must pierce the deck. Some manufacturers of this type of deck now offer an integral hanging system. In cases where there are no integral hangers at the required hanging points, install the rod or strap hangers before concrete placement, or install welded studs after concrete placement. In all cases, the upper attachments to the decking should be in place before the application of fireproofing materials.

6.2.5 Upper Attachment

Upper attachment methods should be selected with care. A safety factor of 4 (based on ultimate failure) is practical unless it can be shown that few unpredictable variables exist and that quality control is disciplined.

6. Hangers

Hangers for phenolic ducts are usually strips of galvanized steel or round steel rod or round galvanized wire or cable. For hangers made of round steel rod, use uncoated hot–rolled steel except where the installation is in a corrosive atmosphere. Where corrosion is a problem, hanger rods should be electro–galvanized all–thread rods or hot–dipped galvanized rods. Where corrosion is a problem for electro–galvanized or hot–dipped galvanized materials, materials of aluminum or stainless steel construction shall be utilized.

7. Lower Attachment

The lower attachment is the connection between the hanger and the duct section. For duct with a greatest dimension to 28 in. (700 mm), fasteners that penetrate the duct may be panel support fasteners. Reference Figure 6-5.

8. Hanger Spacing

A straight duct section is actually a box section beam of considerable strength. As in many structures, the joint is the weakest point, so that is where the

support is. Duct segments up to 154 ¾ in. (3930 mm) in length with a dimension to 44 in. (1118 mm) are normally strong enough to permit maximum hanger spacing at 13 ft. (4 m). Duct segments up to 47 ¼ in. (1200 mm) in length with a dimension larger than 44 in. (1118 mm) are normally strong enough to permit maximum hanger spacing at 6 ft. (1.8 m).

Very wide ducts may require closer hanger spacing in order to limit individual hanger loads to safe values. They also may require intermediate hangers to prevent the upper portion of the duct from sagging. For ducts with dimensions over 80 in. (2032 mm) consult the phenolic panel manufacturer.

9. Trapeze Selection

Trapeze members must be selected with careful attention to the position of the loads on the horizontal bar. Reference Figure 6-6.

10. Riser Supports

Rectangular risers should be supported by angles, channels or framing channel (strut) secured through the sides of the duct with sheet metal screws, blind rivets or phenolic duct panel hanger rod attachments. A sheet metal sleeve inside of the phenolic duct is required whenever screws or other fasteners pass through both sides of the phenolic panel. Riser support intervals should be at one or two story intervals, *i.e.*, 12 ft. (3.66 m) to 24 ft. (7.32 m), as suitable for loading. Reference Figure 6-10.

6.2.11 Hanging System Selection

The selection of a hanging system should not be taken lightly not only because it involves a significant portion of the erection labor, but also because an inadequate hanging system can be disastrous. In any multiple hanger system, the failure of one hanger transfers its load to adjacent hangers. If one of these fails, an even greater load is transferred to the next. The result is a cascading failure in which an entire run of duct might fall.

There are many hanger alternatives, especially in the upper attachments. Besides structural adequacy, the contractor's choice of hanging system must also take into account the particulars of the building structure, the skills of the workmen, the availability of tooling, and the recommendations of the fastener manufacturer. Because of these variables, it is suggested that the hanging system be the contractor's choice, subject to the approval of the mechanical engineer.

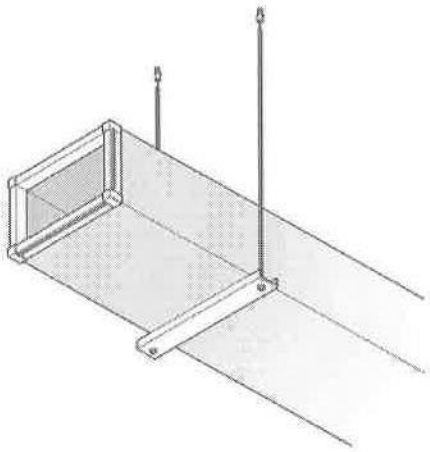
Figures in this manual show typical hanger construction. When special conditions require high safety factors or the ability to withstand vibrations, individual concrete or steel attachments can be specified to be capable of supporting test loads equal to the minimum rating listed when they are tested in accordance with methods described by Underwriters' Laboratories, Inc., for Pipe Hanger Equipment, Bulletin UL 203, latest edition.

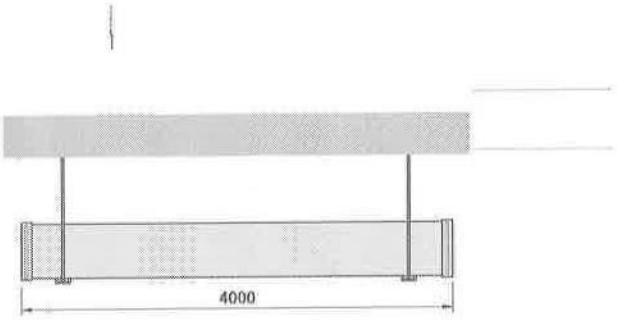
The supports discussed here are not seismically qualified. Refer to SMACNA's *Seismic Restraint Manual Guidelines For Mechanical Systems* for additional reinforcement required by earthquake hazards.

INSTALLATION DETAILS (3)

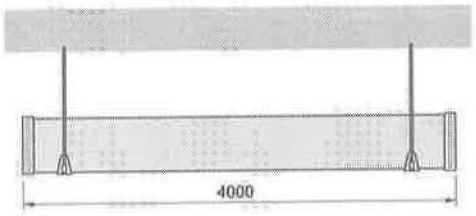
Hangers & Supports

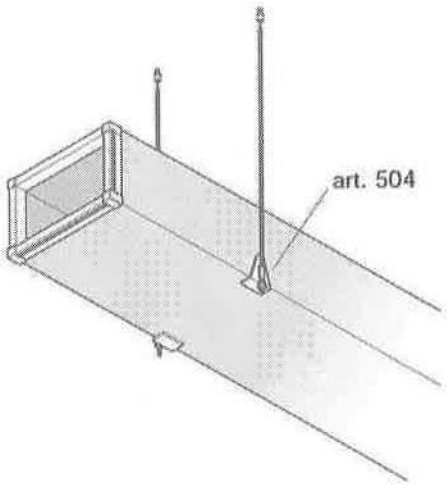
Traditional system





System support





PROJECTS REFERENCE LIST

IM panels and System air ducts have been installed in more than 500 projects around the kingdom of Saudi Arabia and area and in any possible application:

- Hospitals & Operation Theatres
- Hotels
- Commercial Centers
- Industries
- Office Blocks
- Pharma Industries
- Clean Rooms
- Food Industries
- Swimming Pools

Air Ducts

COMPANY

Jiangyin W.T Thermal Insulation Material Co Ltd

No.5,North Waihuan Road,Huangtang Development Zone,Xuxiake Town
Jiangyin, Jiangsu Sheng 214407 China

MH62656

Trademark and/or Tradename:

Note: For additional marking information, refer to the Guide Information Page.

View model for additional information

Air Duct, Rigid, Rigid Duct

Authorized Fabricator, Leminar Air Conditioning Industries LLC, Unigulf Air Conditioning Industries LLC

Last Updated on 2023-11-08

بسم الله الرحمن الرحيم

شهادة ترخيص بإستعمال علامة الجودة

تشهد الهيئة السعودية للمواصفات والمقاييس والجودة بأنها رخصت لمصنع الصناعات المتميزة

بإستعمال علامة الجودة على منتجه التالي :

ألواح العزل الحراري المصنوعة من عديد الإيزوسيانورات الرغوي الجاسئ صنف (١) فقط

حسب المواصفة القياسية السعودية :

رقم ١٥١٩/١٩٩٩م.

ولمدة عام واحد إبتداءاً من ١٤٣٢/١١/٢١هـ الموافق ٢٠١١/١٠/١٩م

والله الموفق

محافظ الهيئة

نبيل بن أمين ملا

رقم الترخيص : ١٤٣٢/٣٤٤

Intertek

Test Report Report No: SHAH0053265103

Application Company: ZHUOZHOU CITY YUANHONG ALUMINUM CO.,LTD. Date: 2015 年 2 月 15 日
Building 1,Dongguan market east road,
shuangta office, zhuozhou city,
baoding city, hebei province

Sample Description:

Sample Name	:	Antibacterial coating aluminum foil
Model	:	A
Assay type	:	Commission Test

****

Test Item:

As the client required, see page renewal.

****

In the page

Approve:

Cheng jun
General Manager
Intertek Testing Services Ltd., Shanghai

第 1 页 共 3 页

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6/F., No. 2 Building, Shanghai Comalong Industrial Park,No. 889 Yishan Road, Shanghai, 200233, China.
上海天祥质量技术服务有限公司
中国 上海市宜山路 889 号齐来工业城 2 号楼 6 楼 邮政编码：200233
Telephone: +86 21 6120 6060 Facsimile: +86 21 6495 4500
www.intertek.com www.intertek.com.cn

DAS Certification

QUALITY MANAGEMENT SYSTEM

Certificate of Approval

This is to certify that the Quality Management System of:

Company name: **Innovative Manufacturing Factory**

Located: P. O. Box 62676, Riyadh 11595
Kingdom of Saudi Arabia

has been assessed by DAS Certification Ltd and found to meet the requirements of:

ISO 9001:2008

The certificate is valid for the following scope of operation:

Production of Pre insulated Ducting Panel Board

Date of Certificate Issue:	*2nd January 2011*
Certificate Valid until:	*1st January 2014*
Certificate Number:	*DASKSA 66454-251*

This certificate is the property of DAS Certification and is valid from 2nd January 2011 until 1st January 2014 and remains valid subject to satisfactory surveillance audits. Re-certification audit before 2nd December 2013 issue 1 certified since 2nd January 2011

Authorised

Date *2nd January 2011*

DAS CERTIFICATION Ltd.
Company Number: 3384526
1 Wellington Close,
Horndean,
Hampshire PO8 0UR
Telephone & Fax: +44 (0) 2392 597888
www.dascertification.co.uk
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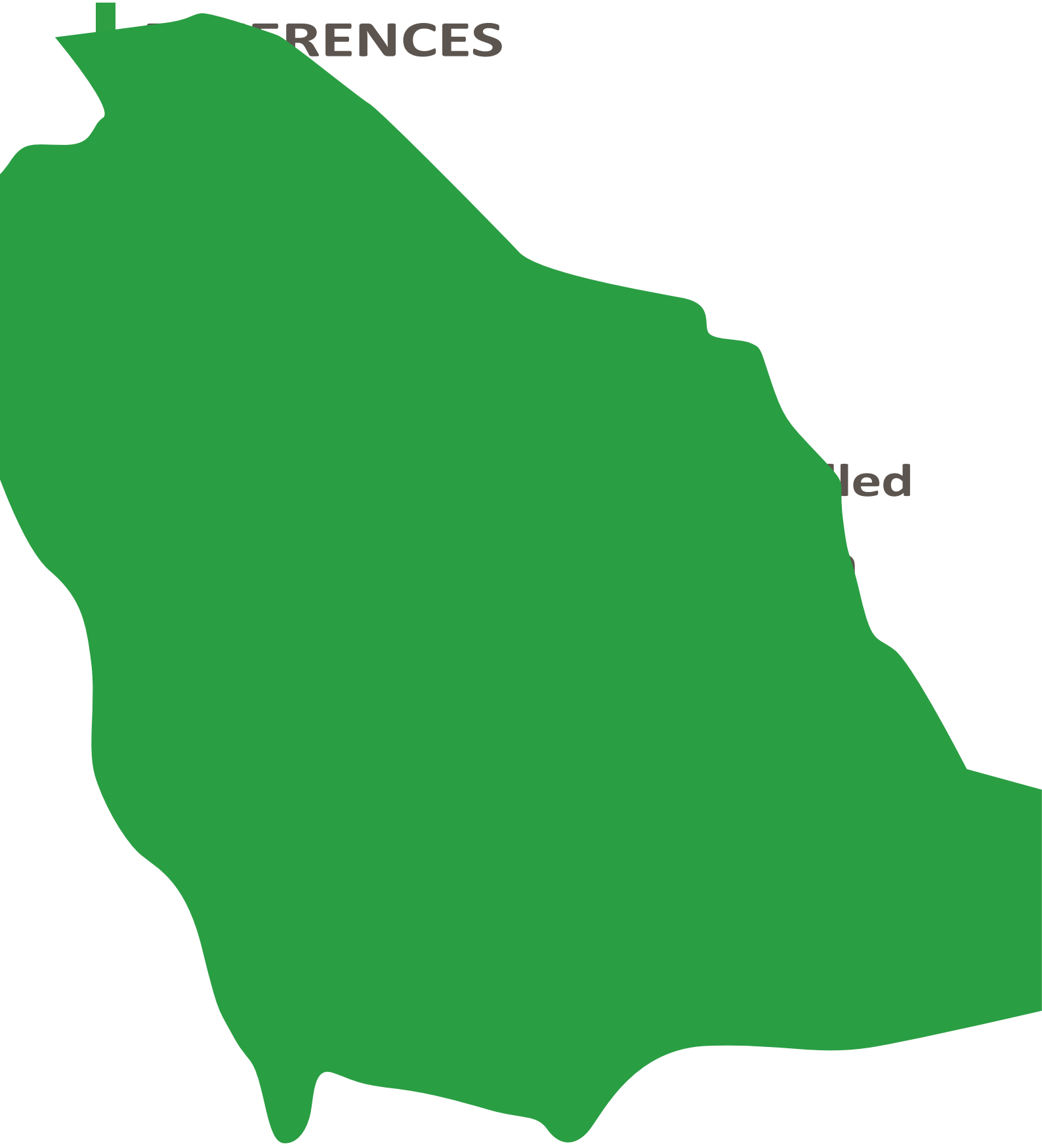
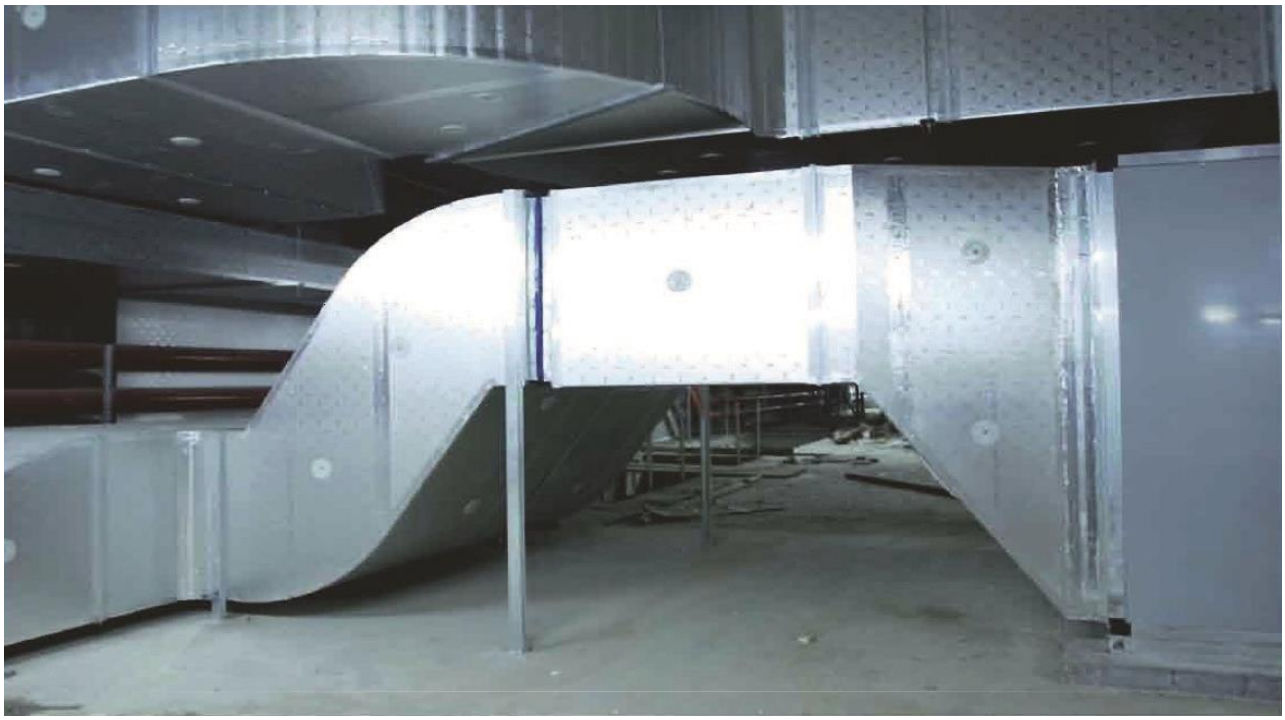


بـرج رفـال

مطار الملك خالد



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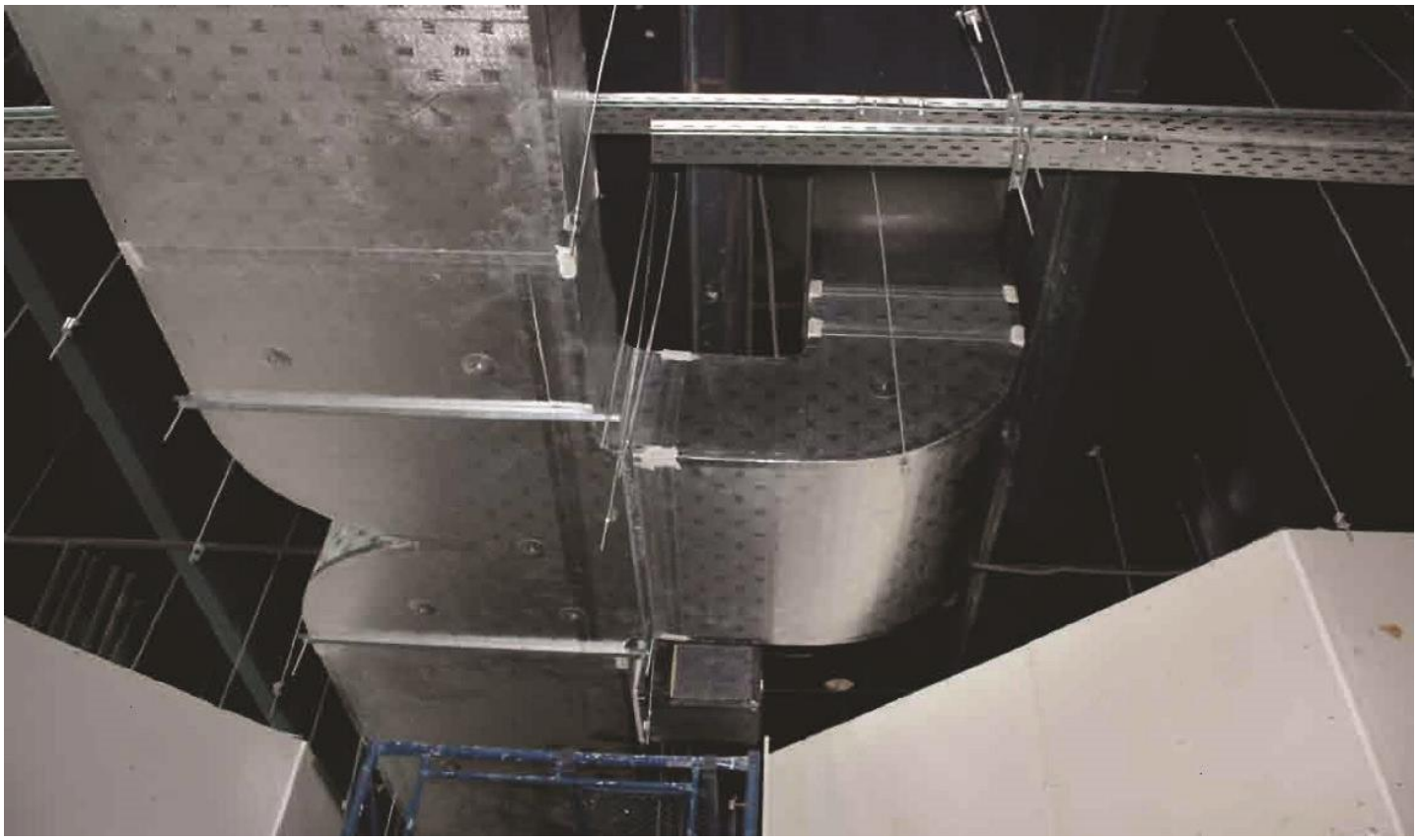

Burj Rafal Riyadh	king Fahad street
GASCO Riyadh	
General State of Survey	
MASCO Riyadh	
Al-Toukhi (SCECO)	
Ministry of Health	Minister OfficeRiyadh
FAD Investment &D	
Panda Hypermarket	Om Al-Hammam, Riyadh
Al-Morjan Sooq	
Warehouse	
Dar Alpha Al-sadhan	
Ministry of Higher Education	
Al-Khaleejeiah's Studio	
National Guard and Special Forces	
STC	Riyadh, Jazan, Arar & ofuf
Saudi Ceramics Factories	
sceco main office building	Riyadh **Sulimaniah** **Riyadh – Ulia** **Dammam Street**

Projects and Sites	location
	Hafof – Faras station
	AL-THOMAMA
	Jeddah
	Al-Kharj – Riyadh
	Sulimaniah- riyadh
	Riyadh
	Riyadh Riyadh
	Riyadh

Projects and Sites	location
Jea'n Hypermarkets	Makah
Holiday Inn Hotel	Dammam
Moevenpick Hotel	Dammam
Tadawi Hospital	Dammam
Al-Shurra' Mall	Dammam
Ministry of Health Hospital	North Province
Aba-Alkayel Eng. Project	Riyadh –Al-Mohamadiah
Al-Hammad Co's Project	Riyadh
Ministry of Defense Riyadh	Aramco
Jeddah	

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other projects . . .

مصنع الصناعات المتميزة

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