**O'Neill Walsh Community Builders** **Submittal Form**

OWCB

**AHSC**

(Project)

**Submittal No.** 001

**Description:** Refrigerant Piping System

**Date:** 07/17/17 **Return By:** 07/31/17

**Division:** 23

**Section:** 23 23 00

Andersen

**Subcontract/Supplier:**

The review by O'Neill Walsh Community Builders ("OWCB") of the above Submittal shall not relieve Subcontractor/Supplier from any of its obligations under the agreement with OWCB nor give rise to any claim in favor of the Subcontractor/Supplier or third parties against OWCB or Owner.

**By:** Logan Bright

O'Neill Walsh Community Builders

Notes:

ARCHITECT

Notes:

ENGINEER

MAKE REVISION NOTED.

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contact documents. Any action shown is subject to the requirements of the plans and specfications. Contractor is responsible for: Dimensions, which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

MFIA, Inc. Consulting Engineers

By: Takako Baker, Date: 7/24/17

Notes:

See attached for submittal review letter.

ANDERSEN HEATING, Inc.

"Your Green Heating & Cooling Professionals
Dedicated to Serving Your and Your Community"

# HVAC Submittals

**Asian Health & Service Center**
**9005 SE Foster Rd.**
**Portland, OR 97266**

**General Contractor**
**O'Neill / Walsh Community Builders**
**2905 SW First Avenue**
**Portland, OR 97201**

**Submitted By**
**Andersen Mechanical**
**16285 SW 85th Ave, Suite 410**
**Tigard, OR 97224**

# 23_23_00

# Refrigerant Piping System

*Andersen Mechanical – 16285 SW 85th Ave, Suite 410 – Tigard, OR 97224 (503)992-6664*
*WA License ANDERH1936QL : OR CCB 168214 : OR Plumbing License PB1464*
*MBE Certification #8561*

PDM US
PREINSULATED PIPES

100% MADE IN THE USA


# GelCopper™
## PREINSULATED COPPER ROLL

## APPLICATIONS

Individual preinsulated rolls that perfectly fits every air conditioning, such as ductless mini-splits, VRF, heat pumps and unitary systems. Available in 50 ft and 164 ft with 1/2", 3/4" or 1" insulation thickness. All rolls are marked by the foot for proper line charging and maximum waste reduction.

## TECHNICAL SPECS

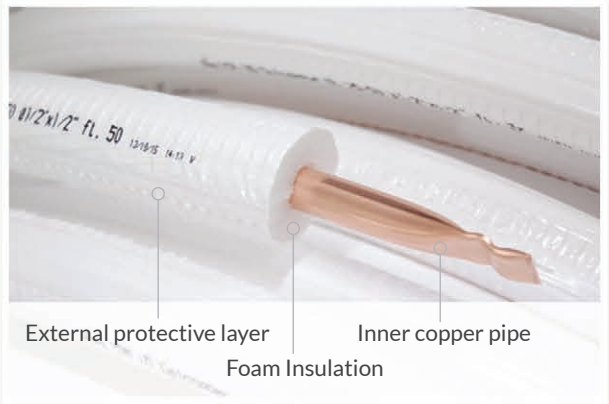
### INSULATION

**Polyethylene closed cell foam:** assures thermal insulation from surroundings
ASTM C 1427-07 compliant
Type I (tubular)
Grade I (insulation material for use on typical commercial system non-crosslinked)
**Low-density polyethylene foam:** closed cells foam, CFC and HCFC gas free
**Water vapor permeability:** ASTM E96-00 compliant
**Working temperature:** ASTM C 1427-07 compliant
**Wall thickness:** 1/2", 3/4" and 1"
**Surface burning characteristics:** UL 94, top rated – UL 723, ASTM E84 (25/50) compliant, flame and Spread Index less than 25 and Smoke Development Index less than 50 as tested according to UL 723
**R-Value:** between 9.0 and 4.0 (depending on pipe diameter and insulation thickness)

OWCB: MFIA to verify soft or hard copper is acceptable.

### COPPER

**Pipes:** Manufactured according to ASTM B280
**Copper:** No. C122200 DHP (phosphorous deoxidized, high residual phosphorous), 99.90%




## SPECIAL FEATURES

**Outer Jacket:** additional white polyethylene jacket cover protects foam insulation from tearing during installation process
**Marking:** insulation incrementally marked by every foot to ensure accurate initial unit charge
**R410a approved:** Gelcopper can be used in applications where high-pressure gases are used as refrigeration source
**UV resistant:** Gelcopper is UV resistant
**Paintable:** the insulation can be painted to match the surroundings

PDM US recommends product installation under plastic duct to protect it from severe weather conditions, accidental damages or theft.

Ph: 803.909.8100 | Fx: 803.909.8725 | E: info@pdmus.com | www.pdmus.com

PDM US
PREINSULATED PIPES


100% MADE IN THE USA

# GelCopper™
## PREINSULATED COPPER ROLL

TRY IT, LOVE IT.

## PRODUCT TABLE

| PDM US PART NUMBER | COIL SIZE | INSULATION | COILS (per pallet) | LENGTH (of coils) |
|---|---|---|---|---|
| F100.GUS145012 | 1/4 | 1/2 | 26 | 50 FT |
| F100.GUS385012 | 3/8 | 1/2 | 22 | 50 FT |
| F100.GUS125012 | 1/2 | 1/2 | 20 | 50 FT |
| F100.GUS585012 | 5/8 | 1/2 | 14 | 50 FT |
| F100.GUS345012 | 3/4 | 1/2 | 14 | 50 FT |
| F100.GUS785012 | 7/8 | 1/2 | 14 | 50 FT |
| F100.GUS1185012 NEW! | 1-1/8 | 1/2 | 6 | 50 FT |
| F100.GUS1416412 | 1/4 | 1/2 | 10 | 164 FT |
| F100.GUS3816412 | 3/8 | 1/2 | 8 | 164 FT |
| F100.GUS1216412 | 1/2 | 1/2 | 8 | 164 FT |
| F100.GUS5816412 | 5/8 | 1/2 | 6 | 164 FT |
| F100.GUS348212 | 3/4 | 1/2 | 10 | 82 FT |
| F100.GUS788212 | 7/8 | 1/2 | 10 | 82 FT |
| F100.GUS145034 | 1/4 | 3/4 | 14 | 50 FT |
| F100.GUS385034 | 3/8 | 3/4 | 14 | 50 FT |
| F100.GUS125034 | 1/2 | 3/4 | 12 | 50 FT |
| F100.GUS585034 | 5/8 | 3/4 | 12 | 50 FT |
| F100.GUS345034 | 3/4 | 3/4 | 10 | 50 FT |
| F100.GUS785034 | 7/8 | 3/4 | 10 | 50 FT |
| F100.GUS1450100 NEW! | 1/4 | 1 | 12 | 50 FT |
| F100.GUS3850100 NEW! | 3/8 | 1 | 12 | 50 FT |
| F100.GUS1250100 NEW! | 1/2 | 1 | 10 | 50 FT |
| F100.GUS5850100 NEW! | 5/8 | 1 | 10 | 50 FT |
| F100.GUS3450100 NEW! | 3/4 | 1 | 8 | 50 FT |
| F100.GUS7850100 NEW! | 7/8 | 1 | 8 | 50 FT |

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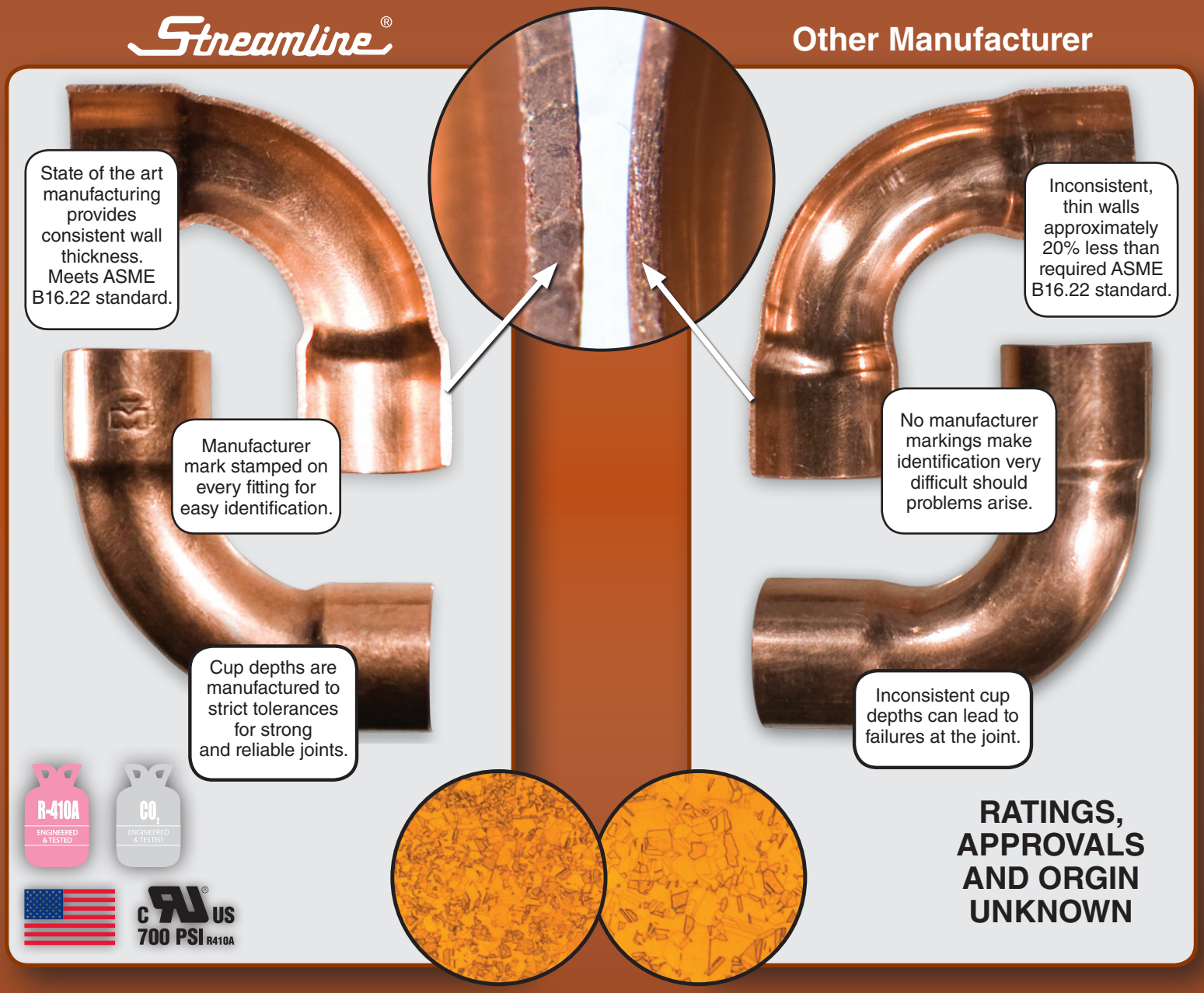
Streamline®
Tube • Fittings • Valves

# THE BEST FITTINGS IN THE JOINT.™

The internal working pressures of R410A and Sub-Critical CO2 can be up to 60% higher than R-22. Trust in the quality and performance of a known leader. In fact, Streamline® Copper Fittings from Mueller Industries are the first fittings on the market to be UL Recognized to 700 PSI.






.055-mm avg. grain Streamline .070-mm avg. grain Other

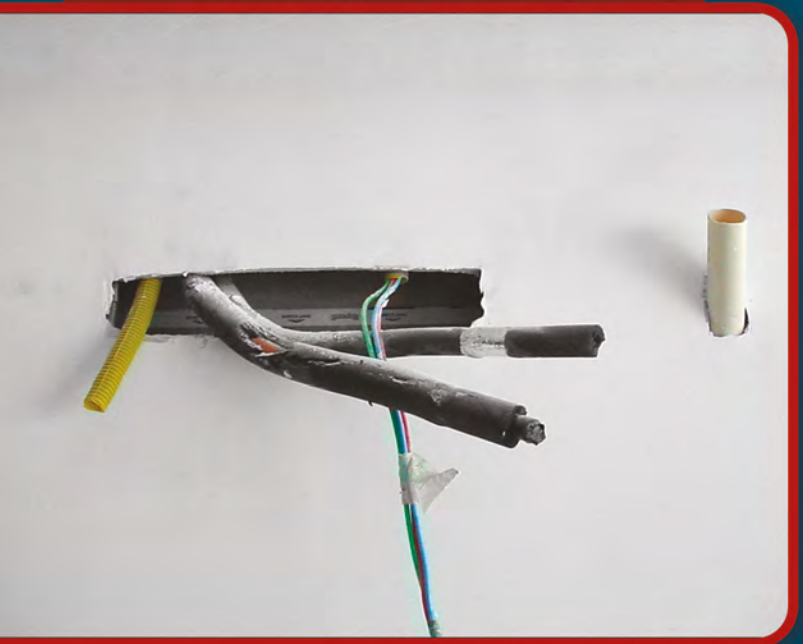
A smaller, tighter copper grain structure results in a stronger fitting. In these sample magnifications at 100x, Streamline's copper outperforms by over 20%.

A BRAND OF MUELLER INDUSTRIES

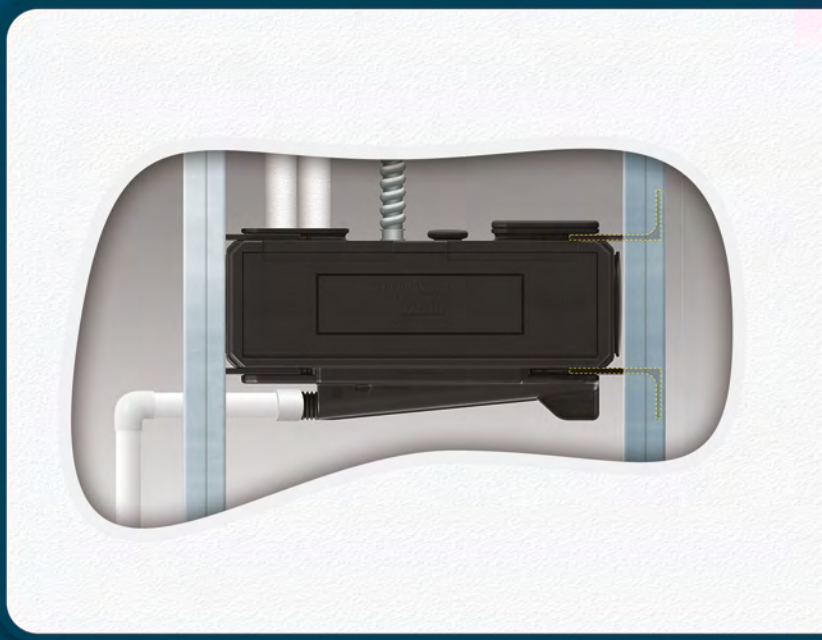
Distributed by Mueller Streamline Co. • 8285 Tournament Drive, Memphis, TN 38125 • **800-846-9750** • www.muellerindustries.com • MLT-116

HVAC

## This is no way to start a Minisplit installation.



## A perfect start ensures a perfect finish!



RoughinBox™ by EXCELAIR

Made in Brazil by POLAR® BUILDING SOLUTIONS

POLAR®
BUILDING SOLUTIONS

MARKETAIR
A WORLD OF INNOVATION

## RoughinBox™ FOR US AND CANADA MINISPLIT PREMIUM CONSTRUCTION STANDARD

Since its inception in 1986 Polar has been recognized as a major developer of innovative solutions for minisplit air conditioner installations in Brazil and surrounding Latin American countries and it has been awarded several prizes, such as CBIC (Brazilian Construction Industry Chamber).

Polar's modern facilities and superior technology have been combined with the marketing expertise of Marketair to develop a new product line specifically for the North American market, to provide an economical solution, enhanced quality and substantial labor saving in the installation process for wall mounted minisplit air conditioners.

Founded by Gerry Spanger in April, 1986, Marketair was established as a manufacturer's representative organization to service wholesale HVACR distributors in the Northeast Quadrant of the USA.

Over the next few years the company became a part of the group of companies founded by Gerry Spanger. This included EZTRAP Inc. and Slimduct Inc. both of which were merged into Airtec Products Corporation in 2008.

During a corporate realignment following the sale of Airtec in August 2011, the local manufacturer's representative activities formerly performed by Marketair were transferred to an associated company, and it continued to develop its international business.

In January, 2016, Marketair was reactivated as an importer, manufacturer and distributor of new and innovative products for the HVACR industry, in which it also operates as a technical and sales and marketing consultancy, both in the USA and internationally.

Marketair is now the exclusive distribuitor for the USA and Canada for Polar Building Solutions, doing business from its main office in Edison New Jersey and a central distribution warehouse in Fort Worth Texas. The company also operates a sales office in Northern Indiana which controls a network of regional sales reps through which it services its national customer base.

RoughinBox™ by Excelair™ is the first of a full range of innovative rough-in-boxes for Minisplit (Ductless) Air Conditioners that deliver premium construction standard for the specialized conditions in the USA and Canada market.

RoughinBox™ by Excelair™, which conforms to current EEC standards, is manufactured by Polar™, who are certified by Tuv Rheinland and CE as an ISO 9000 manufacturer and hold a number of Brazilian and international Patents granted by INPI (National Institute of Industrial Property).

# CUTAWAY VERSION OF INSTALLED BOX

# RoughinBox™ by Excelair & Polar

## FEATURES AND BENEFITS

- Fits perfectly between standard wood or metal studs at 16" centers

2 Faceplate retainer clamps as well as an extra evaporator bracket support are included

Generous inlet ports accommodate larger linesets & thicker insulation

Rounded edges on inlet ports facilitate insertion of linesets and eliminate tearing of insulation

One piece molded construction is completely waterproof

Integral wiring inlet ports accommodate both ½" and ¾" cable

Suitable for use with wood or metal studs (with included adaptors)

Hinged faceplate with retainer clamps provides easy access when roughing in linesets and wiring and protects them during sheet rocking process

- Fully reversible for LH or RH installations

Includes 2 integral side ports for optional side entry of lineset

- Backplate can easily be removed to provide rear access from another room for maintenance, then closed off with an optional white plastic cover plate

Reduced height of 6.6" permits use in space restricted areas over doors and windows

Provides closed off frame ½" proud of stud surface to facilitate sheetrocking

Removable hose barb provides easy connection to plain or insulated minisplit drain hose

Integral stress absorber reduces cracking due to overtorque and provides flexibility for small adjustments

Integral ¾" NPT threaded nipple provides easy connection to rigid PVC or copper pipe

Integral retainer clip keeps evaporator drain hose safely in place

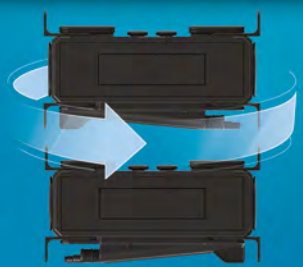
On side drain model RBX-2-SD-NC, asymmetric drain configuration eliminates pooling and facilitates complete drainage

Linear drain pan slope guarantees complete drainage

Multiple fixing holes for secure fastening

- Faceplate is removed when evaporator is installed and can be used as a mounting bracket for condensate pump & reservoir (if required)

**Unique design makes the RoughinBox™ fully reversible**



**PRODUCTS PATENTED IN BRAZIL**

**PATENT PENDING IN USA**

# RoughinBox™ FOR MINISPLIT EVAPORATORS

## RBX1-CD-NC

### Is 10" high and features a center drain for general use

Dimensions: 10" H x 14.5" W x 3.5" D

- Application – New residential or commercial sheetrock construction with wood or metal studs.
- Optional Accessory – TP004 Cover Plate

## RBX2-SD-NC

### Is only 6,7" high and features a side drain for use in space restricted areas over doors and windows

Dimensions: 6.7" H x 14.5" W x 3.5" D

- Application – New residential or commercial sheetrock construction with wood or metal studs.
- Optional Accessory – TP004 Cover Plate

## Accessory and Finishing Cover

*Evaporator Bracket Support*

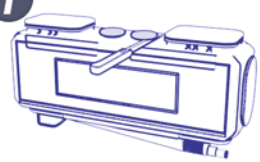
*TPP 004*

## Optional pump installation

# SUMMARIZED INSTALLATION PROCEDURE

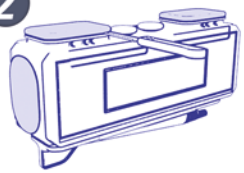
## Preparing the RoughinBox™

**1**



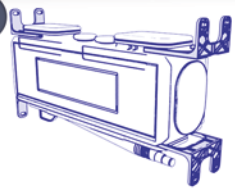
Select ½" or ¾" cable port as required and remove its cap with a knife or hacksaw blade. FACING FRONT OF RoughinBox, SELECT LEFT HAND SLOT ONLY, DO NOT USE RIGHT HAND SLOT AS THIS WILL MAKE CONNECTION OF LINESET VERY DIFFICULT. Remove the slot cap with a knife or hacksaw blade, by cutting only along the marked cut line just below it. DO NOT CUT BELOW THIS LINE AS IT WILL DAMAGE THE SLOT WHICH RETAINS THE MOUNTING ADAPTOR.

**2**



IF USING A CONDENSATE PUMP, DO NOT REMOVE CLOSURE CAP AT END OF DRAIN OUTLET WHICH MUST REMAIN INTACT. If using gravity drain select drainage option required. If using 9/16" (14mm) ID insulated hose, remove closure cap at end of smaller barb, then CHECK THAT ITS ID IS NOT RESTRICTED. If using 5/8" (16mm) ID plain hose, cut off smaller barb. If using ¾" rigid PVC or copper, cut off both barbs to expose threaded ¾" NPT nipple. NOTE: DRAINAGE PIPING IS ATTACHED ONLY AFTER **RoughinBox**™ IS INSTALLED.

**3**



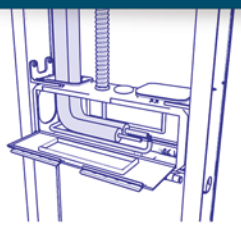
Remove all 4 mounting adaptors from slots at both ends of **RoughinBox**™ invert them so the fixing holes on top face up and fixing holes on bottom face down and replace them into the same slot.

**4**

If studs are metal, determine which end of **RoughinBox**™ will face open side of stud and extend mounting adaptors on that end to their full length of 1 1/8" so that they reach into the stud to touch the flat surface, and lock them into position. IF STUDS ARE WOOD, MOUNTING ADAPTORS WILL NOT NEED TO BE EXTENDED AND THEY CAN BE USED AS IS FOR FIXING.

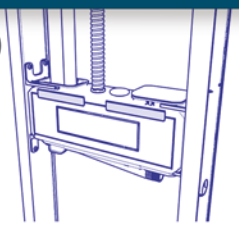
## Installing the lineset & cable

**5**



Cut around faceplate only along top and both side edges (lines 1, 2 and 3). DO NOT CUT LOWER EDGE (4) which forms a hinge so faceplate can fold down for access to interior of **RoughinBox**: Install lineset and electrical cable through ports selected, leaving enough slack to connect both into the evaporator.

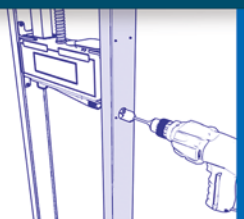
**6**



Using the 2 plastic clips provided, close off the aperture by refitting the faceplate which remains in place until the sheetrock and painting are complete.

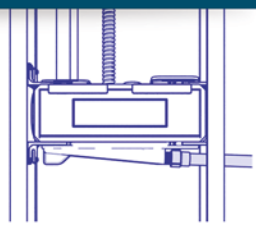
## Installing the drain line

**7**



FOR RBX2-SD (shown) cut an opening in the stud facing the drain outlet and attach hose, PVC or copper coupler to appropriate connector on drain outlet as required. NOTE: FOR RBX1-CD DRAIN OUTLET FACES DOWN SO NO STUD CUTTING IS REQUIRED.

**8**



Attach drain to horizontal outlet if using RBX2 - SD or vertical outlet if using RBX1 - CD. FOR FLEXIBLE HOSE A CLAMP MUST BE FITTED. IF INSTALLING A THREADED PVC OR COPPER ADAPTOR, PTFE TAPE MUST BE USED.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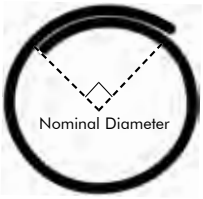
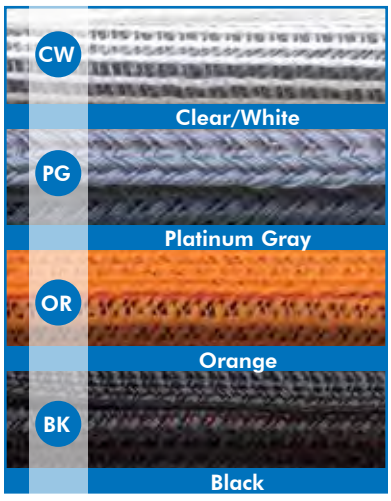
January 2016

# Flexible, Semi-Rigid Wrappable Split Braided Tube

- ***Easy, Cost Effective Installation***
- ***More Flexible than Split Convoluted or Spiral Wrap***
- ***25% Edge Overlap***
- ***Cut and Abrasion Resistant***
- ***Halogen Free***
- ***Retains Shape & Rigidity Throughout -94°F to 257°F Temp. Range***
- ***Melt Temp 482°F***




*The large overlap allows easy installation over splices and inline connectors without exposing wires and cables.*




FLEXO F6's (F6N) unique split, semi-rigid braided construction makes it the ideal solution for situations where ease of installation is of primary importance. The lateral split allows the tube to open up to accommodate a wide variety of bundling requirements, while the the semi-rigid braid configuration simply closes around the entire installation without the need for any additional fasteners (Velcro, tape, etc.). The 10 mil PET braid is lightweight, quiet, and flexible. The 25% edge overlap (at nominal diameter) allows for coverage around inline plugs, connectors, and splices.

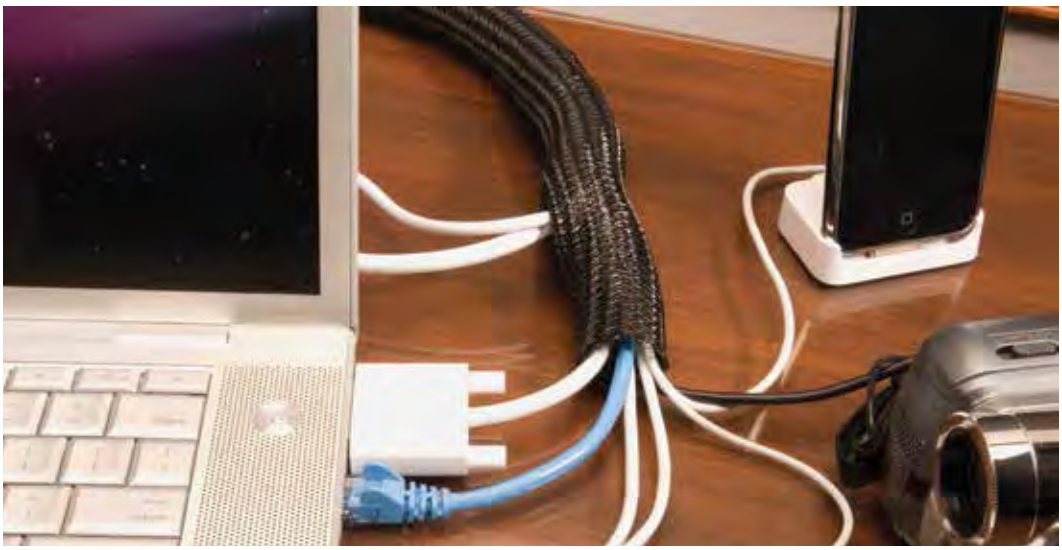
F6N will bend to a tight radius without distorting or splitting open, and unlike full rigid tubing, will not impair or affect the flexibility of harnesses. F6 allows for addition or removal of wires without disassembly.


| Nominal Size | Part # | Wall Thickness | Standard Put-Ups | | | Available Colors | Lbs/ 100′ |
|---|---|---|---|---|---|---|---|
| | | | Bulk Box | Box A | Box B | | |
| 1/8″ | F6N0.13 | .024″ | 10,000′ | 400′ | 100′ | BK, OR, PG, CW | 0.20 |
| 1/4″ | F6N0.25 | .025″ | 3,000′ | 200′ | 100′ | BK, OR, PG, CW | 0.60 |
| 3/8″ | F6N0.38 | .025″ | 1,500′ | 150′ | 75′ | BK, OR, PG, CW | 1.20 |
| 1/2″ | F6N0.50 | .025″ | 1,200′ | 150′ | 75′ | BK, OR, PG, CW | 1.40 |
| 3/4″ | F6N0.75 | .025″ | 500′ | 100′ | 50′ | BK, OR, PG, CW | 1.60 |
| 1″ | F6N1.00 | .038″ | 400′ | 100′ | 50′ | BK, OR, PG, CW | 2.00 |
| 1 1/4″ | F6N1.25 | .038″ | 250′ | 75′ | 25′ | BK, OR, PG, CW | 2.40 |
| 1 1/2″ | F6N1.50 | .038″ | 250′ | 75′ | 25′ | BK, OR, PG, CW | 2.70 |
| 2″ | F6N2.00 | .038″ | 200′ | 50′ | 25′ | BK, OR, PG, CW | 3.60 |

1-973-300-9242
www.techflex.com

ABYC FAR-25


*F6 is available in self-dispensing boxes.*



***F6 Installation Tool***

*This simple tool makes installing long lengths of F6 sleeving a breeze. Just insert your bundle of wires into the shank of the tool and slide it along the split in the sleeving. As the tool travels along the sleeving, it deposits the wires and allows the split to close correctly.*
*See part numbers on page 100.*

# TECHNICAL INFORMATION SHEET

## STAY-SILV® 15 BRAZING FILLER METAL

### NOMINAL CHEMICAL COMPOSITION%:

| | |
|---|---|
| Phosphorus | 4.8-5.2 |
| Copper | Remainder |
| Silver | 14.5-15.5 |
| Other (Total) | 0.15 |

### TYPICAL PHYSICAL PROPERTIES:

| | |
|---|---|
| Solidus | 1190ºF (643°C) |
| Liquidus | 1475°F (802°C) |
| Brazing Range | 1300°F- 1500°F (704°C -816°C) |
| Electrical Conductivity | 9.9 (%IACS) |
| Electrical Resistivity | 17.4 |

### BRAZING PROPERTIES:

Stay Silv 15 brazing filler metal is a frequent choice for brazing copper, especially in brazing air conditioning and refrigeration connections. The alloy has a wide melting range which allows the operator to fill loose connections and "cap" or build up around the finished joint. When heated above its liquidus temperature, however, it will flow into tight connections.

Stay Silv 15 can be used to braze brass with the use of appropriate brazing flux. Stay Silv 15 is not recommended for brazing steel or other ferrous metals due to sufficient lack of joint ductility. It is generally suitable for brazing low nickel, (10% maximum), copper/nickel base metals.

### CORROSION RESISTANCE

Generally similar to the copper base metal, but phosphorus containing alloys, including Stay Silv 15, should not be used if the braze is exposed to sulfur or sulfur compounds in service.

### AVAILABLE FORMS

Standard wire diameters, strip, preform rings, and wound on spools.

### RECOMMENDED FLUX:

No flux is required for copper brazing. For brazing brass or copper to brass Stay-Silv® white flux is suitable for most applications. Harris ECO SMART® boric acid free flux, (powder or paste), is also an excellent choice to promote sound brazed assemblies and comply with European REACH requirements

### SPECIFICATION COMPLIANCE:

ANSI/AWS A5.8 Class BCuP-5, ASME SFA 5.8 Class BCuP-5, QQ-B-654A BCuP-5, ISO 17672 CuP 284

### SAFETY INFORMATION:

WARNING: PROTECT yourself and others. Read and understand this information.
FUMES AND GASES can be hazardous to your health.
HEAT RAYS, (infrared radiation) from flame or hot metal can injure eyes.

- Before use, read and understand the manufacturer's instructions, Material Safety Data Sheets (MSDS), and your employer's safety practices.
- Keep your head out of fumes.
- Use enough ventilation, exhaust at the flame, or heat source, to keep fumes and gases from your breathing zone and the general area.
- Wear correct eye, ear, and body protection.
- See American National Standard Z49.1, *Safety in Welding, Cutting, and Allied Processes,* published by the American Welding Society, 8669 Doral Blvd., Doral, Florida 33166; OSHA Safety and Health Standards, available from the U.S. Government Office, Washington, DC 20402.

### STATEMENT OF LIABILITY- DISCLAIMER



**THE HARRIS PRODUCTS GROUP**
**A LINCOLN ELECTRIC COMPANY**
**4501 Quality Place • Mason, OH 45040 U.S.A Tel: 513-754-2000 Fax: 513-754-6015**
**Additional information available at our web site: www.harrisproductsgroup.com**

*MK Revised 04.16*

DUPONT®

Suva®
refrigerants

ART-14

# Properties and Performance of Suva® 407C and Suva® 410A in Air Conditioners and Heat Pumps

## Introduction

Chlorodifluoromethane (R-22 or HCFC-22) has been commercially available for use in various refrigeration, industrial cooling, air-conditioning, and heat pump applications for over five decades. The low ozone depletion potential of HCFC-22, compared with CFC-11 and CFC-12, and its excellent refrigerant properties have helped facilitate the transition away from CFCs. However, as national and international policy makers continue to strengthen regulations towards the protection of the ozone layer, HCFC-22 and other hydrochloro-fluorocarbons (HCFCs) will be phased out. By identifying potential alternatives for HCFC-22 today, DuPont provides equipment manufacturers and users with time to fully test HCFC-22 alternatives before they are needed.

DuPont has developed Suva® 407C as the equivalent pressure replacement for HCFC-22 in positive displacement, direct expansion air conditioners and heat pumps, and has developed Suva® 410A, a near-azeotrope, as a replacement for use in new equipment designed for the higher operating pressures of Suva® 410A.

## Environmental and Safety Properties of Suva® 407C and Suva® 410A

Suva® 407C is a ternary mixture of hydrofluorocarbons (HFCs) HFC-32, HFC-125, and HFC-134a in the ratio of 23/25/52 wt%. Suva® 410A is a binary mixture of HFC-32 and HFC-125 in the ratio of 50/50 wt%. Environmental and safety properties of Suva® 407C and Suva® 410A are listed in **Table 1**.

**Table 1**
**Environmental and Safety Properties of Suva® 407C and Suva® 410A versus HCFC-22**

| | Suva® 407C | Suva® 410A | HCFC-22 |
|---|---|---|---|
| Ozone Depletion Potential (CFC-11=1.0) | 0.00 | 0.00 | 0.055 |
| Global Warming Potential (CO2=1.0[100 yr ITH*]) | 1600 | 1725 | 1600 |
| Flammable | No | No | No |

*Integrated Time Horizon

The components of Suva® 407C and Suva® 410A have undergone extensive toxicity testing by the Program for Alternative Fluorocarbon Toxicity Testing (PAFT). Results from this testing indicate that the components of Suva® 407C and Suva® 410A have very low toxicity. The calculated DuPont Acceptable Exposure Limit (AEL) of both products, based upon the AEL for each component, is 1,000 ppm, 8- and 12-hour time weighted average (TWA). This AEL is the same as the Threshold Limit Value (TLV) established for HCFC-22.

Suva® 407C and Suva® 410A liquid and vapor compositions are nonflammable and will remain nonflammable during shipping, storage, handling, and use in equipment.

**Table 2**
**Performance of Suva® 407C Relative to HCFC-22 in Unmodified Air Conditioners and Heat Pumps**

| Range of Performance: Cooling Mode[a] | | Range of Performance: Heating Mode[b] | |
|---|---|---|---|
| Relative Capacity, % | –2 to +3 | Relative Capacity, % | –7 to +6 |
| Relative Energy Efficiency Ratio (EER), % | –7 to –3 | Relative Energy Efficiency Ratio (EER), % | –6 to –3 |
| Change in Discharge Temperature, °C (°F) | –8.3 to –4.4 (–15 to –8) | Change in Discharge Temperature, °C (°F) | –10 to 0 (–18 to 0) |
| Change in Discharge Pressure | | Change in Discharge Pressure | |
| bar | +1.03 to +2.76 | bar | +0.62 to +2.34 |
| kPa | +103 to +276 | kPa | +62 to +234 |
| psi | +15 to +40 | psi | +9 to +34 |

[a] Values compared with HCFC-22 in unmodified split system heat pumps and an unmodified window air conditioner using the DOE cooling test conditions A and B.

[b] Values compared with HCFC-22 in unmodified split system heat pumps and an unmodified window air conditioner using the DOE heating test conditions E and H.

## Performance Characteristics of Suva® 407C in Existing HCFC-22 Designs

At typical air-conditioner and heat pump conditions, Suva® 407C performs comparably to HCFC-22 in existing positive displacement, direct expansion equipment. **Table 2** summarizes the actual performance of Suva® 407C versus HCFC-22 (cooling and heating modes) in different units designed for HCFC-22. The units were not modified or optimized for performance with Suva® 407C. Department of Energy (DOE) standard test conditions for cooling (test conditions A and B) and heating (test conditions E and H) were used for this comparison.

These results show that Suva® 407C is an alternative for HCFC-22 that can be used not only in new equipment but also to service existing HCFC-22 equipment. Due to the increase in discharge pressure, it will be necessary to contact the original equipment manufacturer to determine if discharge pressure controls will need to be adjusted to compensate for the higher discharge pressure of Suva® 407C.

Even better performance will be achieved when modifications to heat pump and air-conditioning equipment are made to optimize it for use with Suva® 407C.

## Performance Characteristics of Suva® 410A versus HCFC-22

**Table 3** shows the results of comparison testing between Suva® 410A and HCFC-22 in a system designed for optimum performance with HCFC-22. With the two modifications of a compressor change and an adjustable expansion valve, efficiencies of Suva® 410A were about the same as those of HCFC-22. This suggests that a system designed specifically for Suva® 410A may give better efficiencies than the results indicated in **Table 3**.

Suva® 410A is being positioned by manufacturers as a replacement for HCFC-22 in residential air conditioners and heat pumps because of opportunities for improved efficiency versus HCFC-22 and Suva® 407C. Because of the higher operating pressures of Suva® 410A, its application will be in new equipment designed specifically for this new refrigerant.

**Table 3**
**Performance of Suva® 410A Relative to HCFC-22 in Unmodified Air Conditioners and Heat Pumps**

| Range of Performance: Cooling Mode[a] | | Range of Performance: Heating Mode[b] | |
|---|---|---|---|
| Relative Energy Efficiency Ratio (EER), % | –2 to +2 | Relative Energy Efficiency Ratio (EER), % | +1 to +4[c] |
| Change in Discharge Temperature, °C (°F) | –5 to –6 (–9 to –11) | Change in Discharge Temperature, °C (°F) | –8 (–14[c]) |
| Change in Discharge Pressure | | Change in Discharge Pressure | |
| bar | +9.032 to +10.34 | bar | +7.308 to +9.032 |
| kPa | +9032 to +1034 | kPa | +730.8 to +903.2 |
| psi | +131 to +150 | psi | +106 to +131[c] |

[a] Values compared with HCFC-22 in split system heat pump with capacity-matched compressor using the DOE cooling test conditions A and B.

[b] Values compared with HCFC-22 in split system heat pump with capacity-matched compressor using the DOE heating test conditions E and H.

[c] Values based on 48/52 blend versus 50/50 blend currently in production.

## Influence of Leak/Recharge on Performance

### *Suva® 407C*

Recharging after a leak of Suva® 407C results in minimal impact on system performance, even under worst-case, multiple-leak/recharge scenarios.

If there is a Suva® 407C leak from an operating unit in a two-phase region where mixing occurs (heat exchangers or after expansion device), both vapor and liquid will leak from the unit. The composition of the refrigerant left in the system will remain essentially unchanged from the original composition. After recharging Suva® 407C to the system to get back to the original charge size, the performance of the unit will be the same as its original performance with Suva® 407C.

However, if the unit is not operating and there is a vapor leak from a static two-phase region, the composition of the refrigerant that remains in the unit will change. The refrigerant remaining in the unit will be more concentrated in the high boiling component (HFC-134a) and less concentrated in the lower boiling components (HFC-32 and HFC-125). The effect of this composition shift on the performance of Suva® 407C is summarized in **Table 4**. These data summarize the observed performance of Suva® 407C for multiple recharges of the system after 50 wt% of the refrigerant charge is lost through a vapor leak above a two-phase region.

Three important observations from the data generated in this leak/recharge study are:

- During a vapor leak, the HFC-32 (which is the flammable component in the mixture) remaining in the system decreases with concentration.
- The discharge temperature and pressure moved in a favorable direction during the vapor leak/recharge scenario.
- The capacity loss is limited to 5% as the performance of Suva® 407C levels out after four 50 wt% leak/recharge scenarios. The efficiency loss is limited to 2-3% under these leak/recharge conditions.

**Table 4**
**Actual Unit Performance After 50 wt% Vapor Leaks and Recharges of Suva® 407C**

| | | | Compressor Discharge | |
|---|---|---|---|---|
| Recharge No. | Rel. COP[a],% | Rel. CAP[b],% | Temperature, °C (°F) | Pressure, bar, kPa (psig) |
| 0 | 100 | 100 | 81.3 (178) | 21.4, 2142 (296) |
| 1 | 97.8 | 95.9 | 79.7 (176) | 21.0, 2103 (290) |
| 2 | 97.1 | 94.7 | 80.6 (177) | 20.8, 2080 (287) |
| 3 | 99.1 | 95.2 | 79.9 (176) | 20.3, 2029 (280) |
| 4 | 98.8 | 95.1 | 79.4 (174) | 20.4, 2044 (282) |

[a]Coefficient of Performance (measure of energy efficiency) relative to the Coefficient of Performance of the original charge of Suva® 407C.

[b]Refrigerant cooling capacity relative to the capacity of the original charge of Suva® 407C.

### *Suva® 410A*

This refrigerant has even less tendency to separate during leakage than Suva® 407C. **Table 5** shows the effect of repeated loss of 50% of the refrigerant charge followed by addition of enough new Suva® 410A to restore the nominal amount of charge. After repeated leakage and recharge, the effect on system performance is negligible, with a slight increase in HFC-125 composition that causes the resulting blend to move further into the nonflammable region.

## Charging a Unit with Suva® 407C or Suva® 410A

As with any other refrigerant blend, when charging equipment with Suva® 407C, remove liquid refrigerant from the cylinder and then charge this to the unit. Cylinders of Suva® 407C and Suva® 410A are equipped with liquid and vapor valves. The liquid valve is attached to a dip-tube that extends to the bottom of the cylinder, so liquid refrigerant can be removed from the cylinder as it is standing upright.

**Table 5**
**Theoretical Unit Performance After 50 wt% Vapor Leaks and Recharges of Suva® 410A**

| | | | Compressor Discharge | |
|---|---|---|---|---|
| Recharge No. | Rel. COP[a],% | Rel. CAP[b],% | Temperature, °C (°F) | Pressure, bar, kPa (psig) |
| 0 | 100 | 100 | 88 (191) | 28.1, 2814 (393) |
| 1 | 100 | 100 | 88 (190) | 28.1, 2810 (393) |
| 2 | 100 | 99 | 88 (190) | 28.1, 2808 (393) |
| 3 | 100 | 99 | 88 (190) | 28.1, 2807 (392) |
| 4 | 100 | 99 | 88 (190) | 28.1, 2807 (392) |

[a]Coefficient of Performance (measure of energy efficiency) relative to the Coefficient of Performance of the original charge of Suva® 410A.

[b]Refrigerant cooling capacity relative to the capacity of the original charge of Suva® 410A.

## Lubricants

Evaluations of lubricants for use with Suva® 407C and Suva® 410A are currently being conducted. Because Suva® 407C and Suva® 410A are blends of HFC refrigerants, for most applications, a lubricant other than mineral oil will be required. Polyol ester lubricants are being studied for use with Suva® 407C and Suva® 410A, as well as other HFC refrigerants. You should discuss specific lubricant recommendations with your compressor manufacturer.

## Availability

Suva® 407C and Suva® 410A are available to original equipment manufacturers and through DuPont authorized distributors.

Call (800) 235-SUVA for the name of the nearest DuPont authorized distributor.

## Summary

Suva® 407C and Suva® 410A offer respectively equivalent-performance and higher-capacity alternatives to HCFC-22. Both new refrigerants are nonflammable, have the same low order of toxicity that HCFC-22 has, and yield similar energy efficiency and refrigeration capacity under typical air-conditioner and heat pump conditions. DuPont believes these will be the preferred refrigerants to replace HCFC-22 in new equipment and that Suva® 407C will be the preferred refrigerant in servicing of existing HCFC-22 systems.

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