

UFLEX

FLEXIBLE, STRONG & EASY TO INSTALL

Technical Manual



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UFLEX ACR System

Air Conditioning | Heat Pump* | VRF Systems



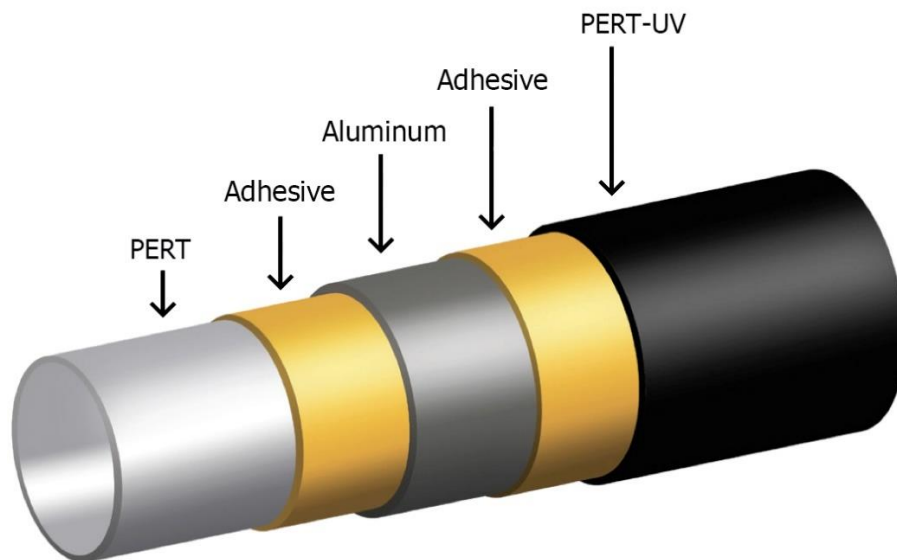
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1. UFLEX ACR SYSTEM

The UFLEX ACR System is the new generation of multilayer pipes for air conditioning. It is specially designed for Mini-Split systems, Heat Pumps* and VRF systems.

The UFLEX multilayer tube is manufactured with PERT (Polyethylene of Raised Temperature resistance) Type II and is made up of two layers of PERT co-extruded with a reinforced aluminum tube between the two layers of PERT. The two layers of PERT are bonded to the aluminum tube with thermoplastic adhesive and its outer PERT layer is UV resistant.



PERT type II has a unique molecular structure with a crystalline microstructure that achieves high resistance at high temperatures without the need for a crosslinking process of the material.

PERT Type II high temperature resistance polyethylene is the material of choice for more demanding applications such as air conditioning / refrigeration, where improved properties are required, such as resistance and performance at elevated temperatures, chemical resistance and resistance to slow crack growth.

* Heat pumps only for cooling and heating applications

UFLEX ACR pipe is manufactured in Germany in compliance with ASTM F3346-19 and ICC-ES LC 1039-2015 Standards for PERT-AL-PERT Type II pipe and fittings for refrigeration use.



1.1 FEATURES

The UFLEX ACR System is designed to withstand the extremes of temperature and pressure associated with Air Conditioning systems. Among the main characteristics of the pipe, its excellent flexibility and low weight stand out, which allows easier and faster installations. It also offers minimal thermal expansion, a total barrier to oxygen diffusion, resistance to corrosion or oxidation, and resistance to ultraviolet (UV) rays. In addition, the tube has a low thermal transmission and vibration transmission, reducing noise and possible failures in the connections, making the installation more efficient and reliable. On the other hand, it is ecological since it does not emit pollutants as in the welding process.

UFLEX ACR is suitable for use with R22, R134 a, R32, R404 a, R407 c, R410 a and R507 Refrigerants. UFLEX's integral pipe and fitting system is designed to prevent leaks and optimize installation.

1.2 BENEFITS AND ADVANTAGES

The system offers multiple advantages over conventional copper tubing:

- Easier and faster installation with quick connections.
- Less rework and waste from cutouts, deformations, and kinking.
- Longer sections without joints or welds, which avoids possible leaks.
- Because it does not contain copper, the risk of theft is reduced,
- Does not corrode like copper in coastal areas.
- Thermal conductivity of 0.42 W/(m*K) while for copper it is 379.14 W/(m*K), making it a more efficient system.
- Less condensation compared to copper tubes

2. TECHNICAL SPECIFICATIONS

The technical specifications of the UFLEX ACR piping system are specified below:

- **Standards:** ASTM F3346-19 and ICC-ES LC 1039-2015
- **Operating pressure:** 580 PSI
- **Maximum pressure:** 650 PSI
- **Operating temperature:** -40°C to 95°C
- **Oxygen diffusion:** 0.000
- **Vacuum tested:** 500 micron / 0.65 mbar
- **Bending radius:** 5xD (D = outer diameter) with pipe bender
- **Coefficient of thermal expansion:** 0.025 mm/(m*K)
- **Thermal conductivity:** 0.42 W/(m*K)
- **Corrosion resistance:** Excellent
- **Detectability:** In walls and floors
- **Lifetime / Garantie:** 30 years / 5 years

2.1 Product Range

The product range of the UFLEX ACR pipe for the different available dimensions are shown in the following table:

Measurement of the ACR Pipe						
Nominal Size	DIM / ASTM B-280	Ø Outside Diameter	Ø Inside Diameter	Wall Thickness	Burst pressure at 25°C	
Outside Diameter x Wall Thickness	Nominal Size Outside Diameter					
mm	inches	mm	mm	mm	bar	psi
12 x 2,50	1/4"	12	7.0	2.5	125	1813
14 x 2,50	3/8"	14	9.0	2.5	115	1668
16 x 2,50	1/2"	16	11.0	2.5	105	1523
18 x 2,75	5/8"	18	12.5	2.75	98	1421
20 x 2,75	3/4"	20	14.5	2.75	92	1334
25 x 3,25	7/8"	25	18.5	3.25	85	1233

3 PRODUCTS AND TOOLS

3.1 PIPELINE

1. PERT-AL-PERT Type II pipe for ACR in diameters from 1/4" to 3/4" (100 m coils) and 7/8" (50 m coils). Also available are factory pre-insulated and condensation protected pipes from 1/4" to 3/4" (50 m rolls) and 7/8" (25 m rolls).



Without insulation



factory pre-insulated

3.2 FITTINGS

2. Compression fitting for pipe diameters from 1/4" to 7/8" as adapter between UFLEX ACR pipe and unit fitting.



3. Pipe coupling as double compression fitting for the safe connection of two pipes with the same diameter, e.g. to move equipment quickly and economically.



4. Soldering transition on copper pipe to make a connection to the pipe socket of a unit or to the branch of VRF systems.



5. Screw fitting male threaded and Schrader maintenance valve for pressure tests or for filling the installed pipe with nitrogen.



3.3 TOOLS

6. Special UFLEX ACR pipe reamer to round and bevel the end holes before installing the compression fitting to prevent damage to the O-rings and ensure a tight connection.



manually applicable



mechanically applicable
(up to a maximum of 500 rpm)

7. Special tube cutter for multilayer pipes to ensure a clean and straight cut without damaging the structure.



8. Outer tube bending springs to ensure uniform bends without passing the minimum radius or deforming the tube and causing damage to the structure and integrity of the tube.



4 INSTALATION

The installer must ensure that it is installed in accordance with the following recommendations and instructions and that it is used only in applications that are designed to operate within the specified temperature and pressure parameters.

The installer is required to be properly trained and pass the official UFLEX installer certification exam available online. Ask your dealer to guide you to take the exam.

4.1 RECOMMENDATIONS

This safety guide provides instructions for the selection and use of the UFLEX ACR system. Given the wide varieties of applications and operating conditions, the user is ultimately responsible for:

- The final selection of the product.
- Comply with the requirements of the user and manufacturer of the equipment, ensuring that the application does not create a health or safety risk.
- Apply the recommended UFLEX and industry standards to maintain the integrity of the warranties.
- Respect the maximum parameters of the UFLEX ACR system.

4.1.1 SELECTION AND USE

Diameter selection: UFLEX ACR tubing must be chosen in accordance with the dimensional standards of ASTM B-280 from 1/4" to 7/8" OD.

UFLEX ACR connectors: Do not use connector sizes other than those specified for the equipment. This can alter operating conditions. UFLEX ACR provides a range of connectors for all types of installation.

Pressure: UFLEX ACR is designed to operate in the temperature and pressure capacities of a wide range of HVAC equipment. Pressures and temperatures can vary dramatically between different manufacturers and system designs. It is the responsibility of the installer to determine if the UFLEX ACR pipe is suitable for the application based on the equipment temperature and pressure parameters and the

capabilities of the UFLEX ACR pipe. The use of low- and high-pressure switches is recommended to avoid extreme conditions. Improper installation can exceed temperature and pressure parameters causing damage to equipment and piping.

Refrigerant Line Type: UFLEX ACR is approved for use in all HVAC suction and liquid lines as long as the operating temperature and pressure are below the limits published by UFLEX ACR.

Compressor discharge line: UFLEX ACR is approved for use on the gas line in heat pump mode (suction line in cooling mode) but should not be connected directly to the compressor discharge line. There is a high risk that in case of a compressor failure or abnormal operation the limit temperature of the UFLEX ACR pipe will be exceeded.

Temperature: Ensure that the temperature (static and variable) of the refrigerant and the environment does not exceed the maximum specifications of the UFLEX ACR tube. Take special care when installing the tube near potential heat sources. Continuous use near the specified maximum temperature can decrease the life of the UFLEX ACR tubing.

Radiant heat: UFLEX ACR tubing can be damaged when exposed to extreme heat sources such as hot exhaust pipes or hot manifolds.

Compatibility with types of refrigerant: UFLEX ACR should only be used with the following refrigerants: R22, R134a, R32, R404a, R407c, R410a y R507 and similar.

Insulation: Although UFLEX ACR pipe has superior thermal conduction properties than copper, it is recommended to insulate it in accordance with applicable standards.

Environment: The UFLEX ACR tube has been designed to resist UV rays, rain, ozone etc.

Physical Damage: UFLEX ACR tubing is very robust but care must always be taken not to cause deformation, bend in a radius smaller than the minimum specified, cut or damage in any other way that may result in premature failure.

Storage: Both the tubes and the connectors should be stored in a dry and clean place. Away from exposure to high temperatures, chemicals, etc.

4.1.2 TORQUE

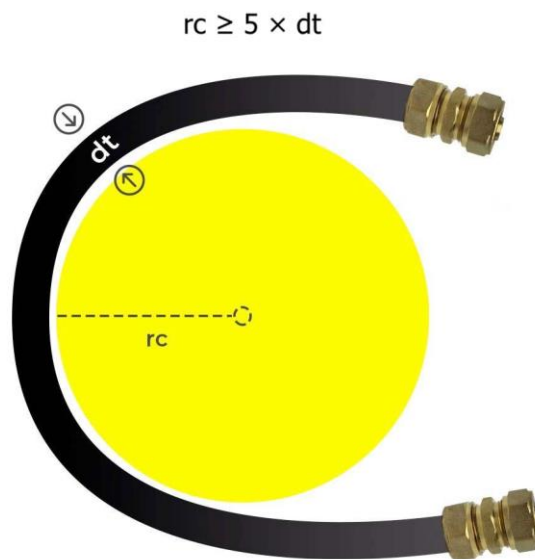
Recommended Torque for flare connector						
UFLEX ACR Tube Size	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
45° Flare Thread Size	7/16" 20UNF	5/8" 18UNF	3/4" 16UNF	7/8" 14UNF	1 1/16" 14UNF	1 1/4" 12UNF
Torque Min Nm	12.2	27	40.5	60.8	107	147
Torque Max Nm	13.5	33.7	47.7	74.2	119	154

Recommended Torque for the compression nut that fastens the pipe						
UFLEX Tube Size	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
	12x2.5	14x2.5	16x2.5	18x2.75	20x2.75	25x3.25
Torque Nm	11	24	28	36	42	54

4.1.3 BENDING RADIUS

The pipe should not be bent to bends less than the radius of 5 times the pipe diameter ($r_c \geq 5 \times D_t$) using the UFLEX pipe bender, as this may damage the integrity of the pipe. If it becomes too bent, leaving a deformation, the section must be cut and repaired with a UFLEX ACR joint. Here are the limits of the radii of curvature for the different sizes:

Bending Radius ($r_c \geq 5 \times D_t$)			
Nominal size	DIM / ASTM B-280	Ø Exterior (D_t)	Bending Radius (r_c)
mm	inches	mm	mm
12 x 2,50	1/4"	12	60
14 x 2,50	3/8"	14	70
16 x 2,50	1/2"	16	80
18 x 2,75	5/8"	18	90
20 x 2,75	3/4"	20	100
25 x 3,25	7/8"	25	125



4.1.4 REFRIGERANT CHARGE

Testing: It is extremely important to apply a vacuum below 500 microns to installations and to pressure test at least 400 PSI (28 bar) on cold only systems and 600 PSI (42 bar) on heat pump systems in order to detect leaks. As with all systems with refrigerant gas, the entry of air, water or other contaminants can damage the equipment and / or the UFLEX ACR tubing.

Refrigerant charge: Once the system is installed and properly tested, the refrigerant gas must be charged within the following specifications:

Liquid Line 4.5 C°							
Tube Size inches (mm)	Inside Diameter (mm)	Flow Area (mm ²)	Exterior Diameter (mm)	Lb charge/ 1 mt	Lb charge/ 5 mt	Lb charge/ 10 mt	Lb charge/ 15 mt
1/4" (12 x 2,5)	7	38.48	12	0.074	0.372	0.744	1.116
3/8" (14 x 2,5)	9	63.615	14	0.119	0.593	1.187	1.780
1/2" (16 x 2,5)	11	95.03	16	0.192	0.961	1.921	2.882
5/8" (18 x 2,75)	12,5	122.71	18	0.245	1.223	2.446	3.669
3/4" (20 x 2,75)	14,5	165.13	20	0.331	1.654	3.308	4.962
7/8" (25 x 3,25)	18,5	268.79	25	0.543	2.713	5.426	8.139

Suction Line 40.5 C°							
Tube Size inches (mm)	Inside Diameter (mm)	Flow Area (mm ²)	Exterior Diameter (mm)	Lb charge/ 1 mt	Lb charge/ 5 mt	Lb charge/ 10 mt	Lb charge/ 15 mt
1/4" (12 x 2,5)	7	38.48	12	0.003	0.015	0.030	0.044
3/8" (14 x 2,5)	9	63.615	14	0.005	0.023	0.046	0.069
1/2" (16 x 2,5)	11	95.03	16	0.007	0.036	0.072	0.108
5/8" (18 x 2,75)	12,5	122.71	18	0.009	0.046	0.092	0.138
3/4" (20 x 2,75)	14,5	165.13	20	0.012	0.062	0.125	0.187
7/8" (25 x 3,25)	18,5	268.79	25	0.021	0.103	0.207	0.310

Discharge Line @ 60 C°							
Tube Size inches (mm)	Inside Diameter (mm)	Flow Area (mm ²)	Exterior Diameter (mm)	Lb charge / 1 mt	Lb charge / 5 mt	Lb charge / 10 mt	Lb charge / 15 mt
1/4" (12 x 2,5)	7	38.48	12	0.016	0.080	0.161	0.241
3/8" (14 x 2,5)	9	63.615	14	0.026	0.128	0.256	0.384
1/2" (16 x 2,5)	11	95.03	16	0.041	0.207	0.413	0.620
5/8" (18 x 2,75)	12,5	122.71	18	0.053	0.264	0.528	0.792
3/4" (20 x 2,75)	14,5	165.13	20	0.071	0.356	0.711	1.067
7/8" (25 x 3,25)	18,5	268.79	25	0.117	0.584	1.167	1.751

4.2 INSTRUCTIONS

The UFLEX ACR system should only be used in applications that are designed to operate within specified temperature and pressure parameters.

Tools: For correct installation, only UFLEX ACR tools should be used. Failure to use the correct tools can lead to system failure and damage.

Visual Inspection of Tube and Connector: As a good practice, it is always recommended to inspect the material prior to installation and after the initial loading and operating procedure. This to detect possible defects, abrasion marks, deformations, cuts etc. Damaged UFLEX ACR tubes will need to be replaced. Corroded, cracked, or damaged O-ring connectors will also need to be replaced.

Bends: Even though UFLEX ACR pipe is much more flexible than conventional pipe, it should not be bent to bends less than 5 times the diameter of the pipe using the UFLEX ACR pipe bender as it may damage the integrity of the pipe (check 4.1.3 Radius of Curvature). If it becomes too bent, leaving a deformation, the section must be cut and repaired with a UFLEX ACR joint. Bends should not be made within 30 cm of the connector to avoid affecting the connection or causing deformations that restrict flow.

Tension: The tube installation should not be too tight. Always allow enough play so that the pipe can expand and contract since with variations in temperature and pressure the pipe can change in length.

Flare Connections: During operation, vibrations and sudden changes in temperature can cause flare connections to loosen. To prevent this, the use of a few drops of a thread locker such as Loctite 242 or Loctite 243 is recommended.

4.2.1 Installation Steps:

1. Cut the pipe perpendicularly with the UFLEX pipe cutter.¹



2. Lay the UFLEX® pipe on the desired installation paths. To bend the pipe, we recommend using the Uflex external bending springs while observing the minimum bending radii ².



3. Select the appropriate size of the connector according to the pipe dimension. Place the union nut on the pipe first, then the clamping ring (can be used on both sides).



¹ The pipe is marked with a metre number, making it easy to cut the required sections without a tape measure.

². Important: Do not bend in with a bending radius of less than 5 times the pipe diameter (see table, page 10).

4. Work the pipe end to be assembled with the original UFLEX® pipe clammer and deburrer (2 to 3 full turns). Make sure that no chips fall into the pipe.



5. Screw the UFLEX® adapter fitting onto the unit valve of the air conditioner (condensor / compressor). We recommend the use of an appropriate copper seal and threadlocker (Loctite 242 or Loctite 243).



6. Use a spanner to tighten the UFLEX® adapter while observing the recommended torques³.



³ Important: For the screw connections (adapters, transitions and couplings) the torques according to the table on page 11 apply.

7. Push the tube into the shoulder of the fitting. Take care not to damage the O-rings.



8. Screw on the connector nut by hand, again using a torque spanner to tighten the connector nut to the recommended torque³. Remember to hold the union in place. It is recommended to fix the union with a threadlocker. (Loctite 242 or Loctite 243).



9. Finally, cover the pipe and the connection with insulation to prevent condensation..



³ Important: For the screw connections (adapters, transitions and couplings) the torques according to the table on page 11 apply.

It is extremely important to draw a vacuum below 500 microns into the facility and pressure test at least 400 PSI (28 bars) on cold only systems and 600 PSI (42 bars) on heat pump systems in order to detect leaks. As with all systems with refrigerant gas, the entry of air, water or other contaminants can damage the equipment and / or the UFLEX ACR tubing.

IMPORTANT: Failure to follow these instructions can void the guarantee.

5 Guarantee

For a period of five (5) years from the date of manufacture, Cube Energy GmbH guarantees that the UFLEX® ACR pipes and fittings are free from material and manufacturing defects. The warranty is only valid if the installation is carried out by a qualified refrigeration engineer or installer with additional qualifications (refrigeration certificate), as well as appropriate instruction with the UFLEX® air-conditioning pipe system. Furthermore, the UFLEX® installation instructions and product specifications must be observed.

CUBE ENERGY will honour claims relating to the failure of its products only if it receives written notice of the failure or defect within twenty (20) days of the failure or discovery of a defect alleged to be a breach of this warranty. For this purpose, please enclose a copy of the purchase invoice for the item to be complained about as well as the duly completed UFLEX® guarantee claim form. The customer will receive a Return Authorization Number with which the defective part must be returned.

Upon receipt of the item, CUBE ENERGY will perform an evaluation of the claim. CUBE ENERGY will not accept any claim under this limited warranty arising from parts that fail due to normal wear and tear, misapplication, improper installation, modification, misuse or abuse of the product, negligence, or circumstances beyond the manufacturer's immediate control. If the claim relates to a manufacturing defect, CUBE ENERGY will, at its option, repair or replace the defective product or refund the cost of the defective UFLEX® pipes and accessories. Upon receipt, review and approval of a quote from a qualified installer for such replacement, CUBE ENERGY will pay the labour and material costs reasonably used to replace such pipes and fittings.

This guarantee excludes all claims and CUBE ENERGY expressly disclaims all liability for consequential, incidental, indirect or special damages resulting from any defect or deficiency covered by this guarantee, including but not limited to labour costs incurred in the use. Or incidental or consequential to the repair or replacement of any part or parts, or for loss of time, profit, transportation costs, or indirect incidental damages or inconvenience. CUBE ENERGY offers no other warranties, express or implied, in this manner or otherwise, except as expressly set forth herein.

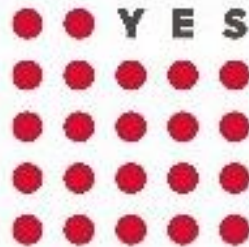
UFLEX® ACR tubing should be used only with UFLEX® tooling and compression fittings. During all phases of such use, including installation, evacuation, filling and commissioning, standard cooling practices must be followed and these practices must comply with the applicable standards and rules of practice for refrigeration piping. This product must be installed by a certified UFLEX® licensed HVAC installer who must review

and comply with state and local codes and equipment manufacturer warranty requirements. The installer must be familiar with the manufacturer's installation requirements. Failure to comply with these rules and requirements will result in the limited warranty being unenforceable. In the event of damage, Cube Energy is entitled to demand the refrigeration certificates of the employee who assembled the article that is the subject of the complaint. It should be noted that the gratuities are personal. For more information about the guarantee, contact the customer service area at the e-mail address: info@cubeenergy.de.

UFLEX

FLEXIBLE, STRONG & EASY TO INSTALL

Air Conditioning • Heat Pump* • VRF System



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