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USE OF CARLY COMPONENTS

- CARLY components are designed for use with CFCs, HCFCs, HFCs and CO_2 as well as with their associated oils and additives; these are non hazardous refrigerants from group 2 of the Pressure Equipment Directive 2014/68/EU.
  For the use of CARLY components with refrigerants of group I, type hydrocarbons – Propane R290, Butane R600, Isobutane R600a, Propylene R1270, please contact CARLY technical service.
- The label on the products with the CE marking, must remain visible and must not be covered nor damaged.
- Refrigerants used are particularly expansible depending on the temperatures they bear. Consequently, they can produce very important pressure variations, which are function of these temperatures and the areas on which these pressures apply. In consideration of the law of mechanics and fluid thermodynamics, and in order to avoid any phenomenon linked to hydrostatic forces, some precautions are mandatory; for instance, one must ensure that none part of the circuit, and especially none component at any time might be full of liquid without the protection of a device such as a safety valve in order to protect from an overpressure that would excess the maximum working pressure admissible in this part of the installation. This recommendation especially applies to installations using the technology of sub cooling of the refrigerant. Not respecting this rule may have serious material and corporal consequences.
- Pressure equipments present some danger. During their handling, it is mandatory to take the necessary safety measures and to wear the individual protections according to the regulation in force.
- Only a skilled personal (EN 13313) trained and initiated to interventions on refrigeration installations and pressure equipment, and with the qualifications required by the regulation of the country of use, is authorized to install CARLY components.
- Respect admissible pressures and temperatures, indicated on the label or marked on the products.
- Take all the necessary measures in order to avoid liquid hammer phenomenon, especially at the starting-up of the installation.
- It is important to check regularly the pressure drop due to components, and to replace them as soon as they produce a level of pressure drop that could trouble the right working of the installation.

COMPONENT INSTALLATION

- Check that the component and its packaging actually bear the references corresponding to the model selected.
- A close attention must be paid to the preparation and the realization of the assembling, that is to say:
  - Ensure that the tubes are cut in right angle, and that the ends have a perfectly circular shape, without oval ;
  - Eliminate burrs and unevenness due to pipe cut; to be made rather by a pipe cutter than with a saw ;
  - Pipe bending has to be made in a way that avoids modifying the shape of the ends.
- The components and the piping used must be totally clean, dry and sealed at ends, before their use; to that purpose, check that the components' blanking plugs are always properly in place and remove them at the last moment only, just before installing them on the circuit.
- The pipe network of the installation must be as short and compact as possible and must not create oil traps in the lower parts of the network ; suction pipes have to be designed taking into account the oil return to the compressor.
- In order to prevent internal condensation phenomena, the components must be at a temperature higher or equal to the ambient temperature, before being installed.
- Most components have a precise way of mounting that has to be respected, taking into account the direction of the refrigerant flow inside indicated by the word ''IN" marked on the inlet end of the component or an arrow printed on the label.
- Ensure that the component is installed at the right place of the installation and mounted in the right direction (horizontal or vertical).
- Components must not support any additional stresses from the pipes or the supports of any type.

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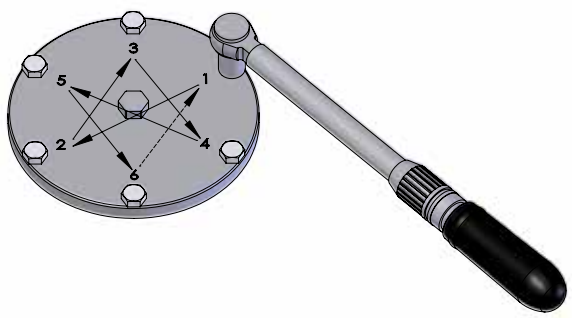
COMPONENT INSTALLATION

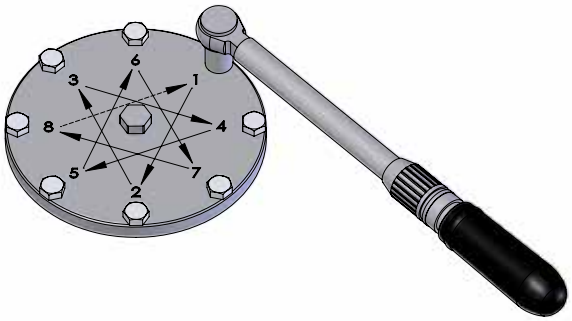
- When installing components with replaceable elements, or accessible for cleaning, such as: BDCY, BCY, BCT-HP, ACY, BBCY, BACY, HCYBF, TURBOIL-F, provide necessary space for their assembly and disassembly. This dimension is specified in the technical characteristics table of the component.

- **Procedure of tightening crossways for flanges of demountable products**
  - After positioning the gasket in the groove of the flange, put the flange back on the component, position all the screws and tighten them by hand until contact.
  - First tightening pass: must imperatively be done crossways and with a relatively low value (see sketch and values hereafter), in order to properly position the gasket.
  - Second tightening pass: must be able to correct de tightening inhomogeneities; the order of tightening the screws staying the same.
  - From the third to the last tightening pass: it must achieve the desired nominal effort; i.e. the specified torque. The screws tightening must always be done in the same order as previously. To give the gasket the time to creep, it is recommended to wait few minutes before doing the last pass.
  - For components with flanges with 10 holes, six tightening passes are recommended in order to achieve the recommended tightening torque.
  - If dispersions exist between the screws, it is recommended to carry out other passes, until obtaining the correct torque on all the screws.
  - The values of torque tightening and the order for the cross tightening of the screws are as follow:

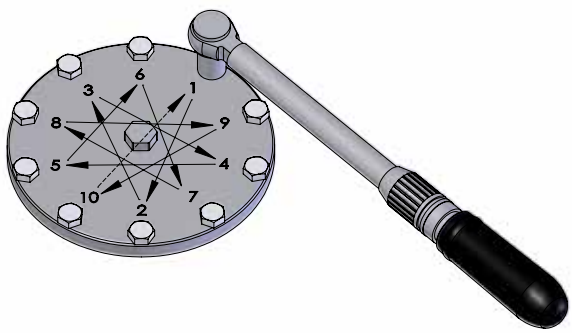
Tightening for screws M8 CL 10-9 - Flange 6 holes BDCY - TURBOIL-F 2505 S/MMS --> 3011 S/MMS	
Stage 1	Tightening the screws by hand
Stage 2	Tightening torque : 5 Nm
Stage 3	Tightening torque : 10 Nm
Stage 4	Tightening torque : 20 Nm
Stage 5	Tightening torque : 30 Nm



Tightening for screws M8 CL 10-9 - Flange 8 holes ACY - BCY - TURBOIL-F 15017 S/MMS --> 30025 S-MMS	
Stage 1	Tightening the screws by hand
Stage 2	Tightening torque : 5 Nm
Stage 3	Tightening torque : 10 Nm
Stage 4	Tightening torque : 20 Nm
Stage 5	Tightening torque : 30 Nm



Tightening for screws M10 CL 10-9 - Flange 10 holes BACY - BBCY - TURBOIL-F 7011 S/MMS --> 9017 S/MMS	
Stage 1	Tightening the screws by hand
Stage 2	Tightening torque : 5 Nm
Stage 3	Tightening torque : 10 Nm
Stage 4	Tightening torque : 20 Nm
Etape 5	Tightening torque : 35 Nm
Stage 6	Tightening torque : 45 Nm
Stage 7	Tightening torque : 55 Nm



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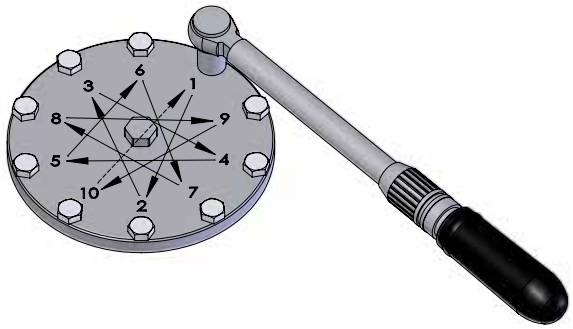
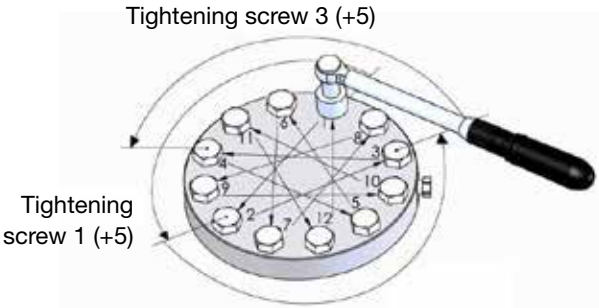
COMPONENT INSTALLATION

Tightening for screws M8 CL 10-9 - Flange 10 holes BCY-P6	
Stage 1	Tightening the screws by hand
Stage 2	Tightening torque : 5 Nm
Stage 3	Tightening torque : 10 Nm
Stage 4	Tightening torque : 20 Nm
Etape 5	Tightening torque : 30 Nm



Tightening for screws M 16 CL 8-8 - Flange 12 holes BCY-P14	
Step 1	Tightening the screws by hand
Step 2	Tightening torque : 25 Nm
Step 3	Tightening torque : 50 Nm
Step 4	Tightening torque : 100 Nm



- Before any intervention, ensure among other things that :
  - The electric part of the installation is confined ;
  - The components to be installed are available, in order not to open the circuit by anticipation ;
  - The components are at ambient temperatures in order to avoid burns. If necessary, wear the appropriate protections ;
  - The installation is empty of refrigerant / gas. Vacuum (-1 Bar) can be made in the products during maintenance operations. During an operation of maintenance, the refrigerant / gas of the installation has to be recovered and recycled in conformity with the regulation in force;
  - The components are protected from bumps in order to avoid damages to the paint and the anticorrosion protection ;
  - The components are protected from seismic and fire risks.
- After each installation or replacement of a component, always check that :
  - The air tightness of this component and its assembling on the circuit, according to the regulation in force ;
  - There is no vibration in the pipe.
- Perform all recommended operations according to the art and to the intervention to perform: circuit rinsing, draining, air tightening, depressurization, refrigerant load…
- The persons responsible for commissioning of CARLY components must ensure that these components will never be exposed to vibration stresses that could cause resonance. Such situation would definitely cause breakage that would be harmful for the installation.
  This monitoring must apply most particularly to “on-board” installations.

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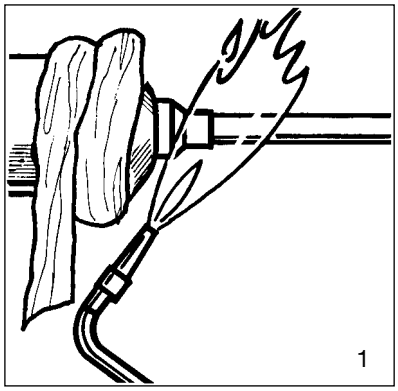
ASSEMBLING COMPONENTS WITH SOLDER CONNECTIONS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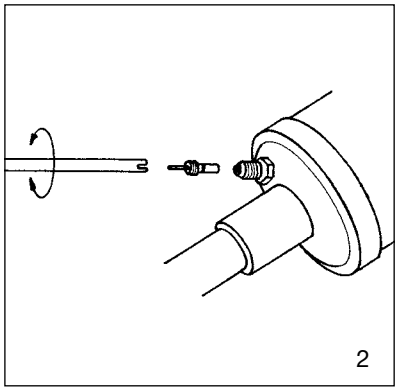
2

- Never braze nor solder on an installation charged with non-confined refrigerant (preferably, the refrigerant has to be stored in the liquid receiver).
- Rigorously clean the internal and external fitting surfaces.
- Ensure that the intake material selected matches the materials and refrigerants used.
- The component's body must imperatively be cooled during brazing: with a humid cloth (**sketch No. 1**), or with **CARLYCOOL** calories discharger (refer to chapter 95) in order not to exceed the maximum working conditions of the product.
- Seals and removable internal elements of CARLY flanged products (**BDCY, BCY, BCY-HP, ACY, BBCY, BACY, FILTRY, VCYLS, VCYR**) must absolutely be removed, before the operation of brazing, and reinstalled only after the heated areas have been cooled to the ambient temperature again.
- Some CARLY components contain "Schrader" type access valves. In the case of brazed components, be careful to remove the internal mechanism of these valves before brazing, in order to preserve the built-in gasket (**sketch No. 2**).
- For the brazing of connections, use a wide flame welding torch; this one has to be adjusted in order to ensure a quick and uniform heating of the connections and be oriented only towards them, avoiding any overheating; an excessive heating of the component paint may produce toxic fumes and trigger serious injuries: the brazing of components has to be performed only in perfectly ventilated areas.
- **ATTENTION**: products of brazing and stripper flows may produce some toxic fumes; read carefully the instructions of the different suppliers and follow their safety rules. It is important to plan an efficient suction at the level of the flame, with an appropriate outlet.
- The intake metal has to melt at the contact of the heated part, and not at the contact of the flame; on a copper tube, it is important to always move the flame in order to avoid any overheating of the tube; the dark red color is an indicator of the limit temperature not to excess; above this temperature, the copper pipe might suffer irreversible damages; in case of parts with different conductivities or weights, a soft pre heating has to be performed on the part with the highest thermal inertia.
- During brazing, use an inert protection gas inside the component (nitrogen for instance) in order to prevent the formation of oxide particles that are going to contaminate the circuit; the protection gas flow must preferably follow the direction of the product flow, in order to avoid damages to sensitive internal elements (**DCY**s' felt-glass filtrating medium, for instance).
- Check the air tightness (with the leak detector **CARLYLOC**) in order to check there is no leak in the different assembling parts and to be in conformity with the regulations in force.
- Eliminate by brushing the residues of brazing fluxes and the possible dirts present outside the heated surfaces.
- A visual check of the brazing made will be the first mandatory control to make, in order to realize the external state of the brazing; it enables to remark the defaults arising on the area (porosity, bad filling, irregular shape of the brazing cord, link defaults).
- After cleaning, protect the heated areas of steel connectors, by the application of paint or other anticorrosion protection products/devices such as **CARLYCOAT**, or cold galvanization, for instance.
- Always close the ends of used components after replacement, in order to avoid the possible release of refrigerants and oils. The elimination of these components must follow the regulations in force.

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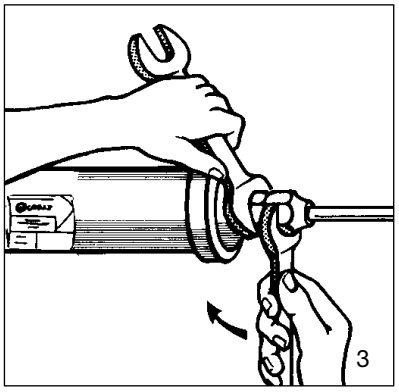
ASSEMBLING COMPONENTS WITH SCREW CONNECTIONS

- Never unscrew the components in an installation full of non confined refrigerant (preferably, store the refrigerant in the liquid receiver).
- Systematically check the dudgeon condition on the copper piping, in order to ensure good air tightness of the assembly; if copper gaskets are used, check their good positioning and replace them after each product removal.
- In order to ensure a better confinement of the installations including components with connections to screw on dudgeons, CARLY highly recommends to replace the dudgeon device by the installation of connection sets, type **KRCY**. See photo and chapter 71 of the technical catalogue.

- Tightening of Flare connections should imperatively be performed with two wrenches, positioned on the six faces of the connections, in order to prevent piping twisting (**sketch No. 3**).
- Comply with the tightening torque recommended in the **"Specific recommendations "** chapter for each component concerned.
- Check the air tightness (with the leak detector **CARLYLOC**) in order to check there is no leak in the different assembling parts and to be in conformity with the regulations in force.
- Always close the ends of used components after replacement, in order to avoid the possible release of refrigerants and oils. The elimination of these components must follow the regulations in force.



PERIODICAL INTERVENTIONS

- Plan a periodical control as often as necessary and in conformity with the regulation in force, of the installation air tightness and of the state of the refrigerant and the oil (moisture, acidity, dirt…) in order not to trouble the efficiency of the installation.
- Make a visual check of the external area of all components on the circuit, in order to detect:
  - Bumps ;
  - Points of corrosion ;
  - Traces of refrigerant leak ;
  - Seepage of oil ;
  - Traces of moisture or ice in service ;
  - Vibration of the pipes connected to components ;
  - Damages to component supports.

  Correct the defaults found.
- Monitor the pressure losses of dehydrating, acid neutralizing and filtering components generally located on the liquid, suction and oil lines. Their contaminant neutralization capacities are by definition limited in time. The saturation and obstruction time depends on the contaminant types and amounts and depends of course on the capacity of the component selected.
- After each opening of the circuit, the **DCY**, or **DDCY**, filter drier or the **CCY 42/48/100 HP** and **PLATINIUM 48/100** drying cores have to be replaced in order to keep the circuit dry enough.
- Replace systematically synthetic air-tightness gaskets after each intervention that requires the dismounting or the opening of flanged products.
- During any intervention, the opening of the refrigeration circuit must be as short as possible; if it were not the case, close the system as hermetically as possible, and charge it with a slight overpressure of dry nitrogen, in order to avoid the introduction of moisture.
- During maintenance operations, the refrigerants of the installation have to be recovered and recycled according to the regulation in force.

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SPECIAL PRECAUTIONS FOR COMPONENTS USED IN CO_2 SUBCRITICAL APPLICATIONS

- The maximal working pressure and the power variations of the installation must be taken into account as of its design, in order to select all the components consequently.
- The pressure of the circuit during the stop phases must also be taken into account, because it can be very high, due to the pressure equalization according to the ambient temperature; several solutions exist to limit and control this pressure when the installation is stopped.
  - Design of the installation allowing to resist to this pressure.
  - Implementation of a « buffer » volume of storage or expansion (receiver).
  - Installation of a secondary circuit with valve or solenoid valve, allowing the fluid transfer to the coldest point, or the less high in pressure of the installation.
  - Implementation of a small separate refrigeration unit, to maintain the liquid temperature at a pressure lower than the maximal working pressure ; it is so far the most effective technical solution, but with a major drawback, which is the power failure (safety unit to be considered, or backup power supply).
- The hot gas defrost, frequently used with CO_2 for low temperatures applications, generates also high pressures (to take in consideration)
- The implementation on the liquid line of a filter drier **DCY / DCY-P6 / DCY-P14** or of a drier shell **BCY-HP / BCY-P6 / BCY-P14** equipped with drying cores **CCY HP** or **PLATINIUM**, is highly recommended. Serious problems can occur in the presence of moisture, such as expansion valve blocking and formation of dry ice even carbonic acid. To avoid this, it is imperative to limit the circuit openings in order to avoid air introduction, causing the condensation in the pipes, and to proceed to a high evacuation of the installation, before any commissioning or restarting.
- For an operation with CO_2 at low temperature, provide thermal insulation on the components which can be covered by frost.
- There is no incompatibility between CO_2 and the main metallic materials commonly used in refrigeration systems (steel, copper, brass...)
- On the other hand, there is a real compatibility issue between CO_2 and polymers. For example, swelling phenomena and internal explosion of the seal are possible. Carly components do not have polymer gaskets directly in contact with CO_2.