WARRANTY ~ GUARANTEE

Congratulations for selecting HyChill Hydrocarbon Refrigerant –
a high performance refrigerant that is climate friendly.

The Consumer benefits from certain warranties and conditions implied by Federal and State legislation. By law these benefits cannot be withheld. This warranty offers the following benefits to consumers in addition to, and without restricting in any way, the benefits conferred by law. This warranty shall be read in conjunction with consumer rights at law

This warranty is for a period of twelve months from date of installation of the HyChill Refrigerant and is limited to replacement of the refrigerant or reimbursement of the purchase price, at HyChill's discretion.

Consequential losses are expressly excluded.

Where the customer believes there is a fault with the refrigerant, the remainder of the refrigerant in the supplied container must be returned to HyChill in order for the customer to be eligible for replacement or reimbursement. Freight and insurance for the return of the refrigerant and container is at the customers expense. If HyChill elects to replace the product, freight and insurance of the replacement will be borne by HyChill..

Fitness for purpose of the supplied refrigerant is ultimately the responsibility of the installer, as they are the only person(s) able to assess the specific application in sufficient detail.

Warranty registration card

Equipment: _____

Serial No. _____

Customer Name: _____

Date of Installation: _____

Place of Installation: _____

HyChill Refrigerants
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Email: info@hychill.com
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ABOUT US

From humble beginnings in 1995 when Colin Spencer and John Clark pooled resources and “know how” to produce the first few hundred cylinders of Australian made HC refrigerant, they have lead the way in the development and promotion of hydrocarbon refrigerants, culminating in the introduction of the HyChill brand in 1999.

HyChill delivers quality products through unique, state-of-the-art manufacturing techniques and quality control procedures, setting a benchmark for industry standards. With worldwide distribution capabilities and a developing international network, HyChill provides a comprehensive service that has given rise to their current position as market leader. HyChill has achieved an annualised growth averaging over 30% since commencing operations and is now the market leader in Hydrocarbon Refrigerants in Australia.

THE BENEFITS OF HC REFRIGERANTS

HyChill's hydrocarbons deliver a huge array of benefits to the environment and to the consumer. Created by nature, not by a chemical company, hydrocarbons cannot be patented, keeping them affordable and available to everyone. They have an atmospheric life of less than one year with no effect on the ozone layer and virtually no contribution to global warming. Many important qualities found in HyChill product's make them an extremely efficient and reliable choice for most air conditioning and refrigeration systems.






Use of existing charging equipment:
The equipment currently used for existing refrigerants requires no modification or change for charging hydrocarbon refrigerants.

Since no retrofitting is required, HyChill refrigerants are the perfect "drop in" solution for systems, which previously used gases such as CFC R12, HFC R134a, HCFC R22, R502, R11 and others.

Less Energy Use
Hydrocarbon refrigerants in refrigeration or car air-conditioning systems use less energy than fluorocarbon refrigerants.

This provides a number of benefits:
- Operating costs are lower.
- Compressor loads are reduced, which reduces wear and tear, extending component life and reducing leakage.
- Less energy consumed means less fossil fuel burned resulting in lower global warming.

Increased Safety
Most importantly, the safety of hydrocarbon refrigerants is assured when the application complies with relevant safety standards, such as International Standards ISO 5149, BS 4434-1995, and Australia/New Zealand Standard AS/NZS 1677-1998.

Research
Hydrocarbon refrigerants have been the subject of detailed studies by many organisations including:

- Minus 40 Refrigeration Consultants & Design Engineers
- INFRAS - Chennai, Pondicherri, India
- Swiss Contact S.M.E.P. - Indonesia, India, Sri Lanka
- Natural Refrigerants Transition Board
- Arthur D Little - Risk Assessment Study Engineers
- Granherne P/L - Risk Assessment Study Engineers
- Maclaine-cross, I. L., Usage and Risk of Hydrocarbon Refrigerants in Motor Cars for Australia and the United States, June 2004, International Journal of Refrigeration, Volume 27, No. 4, pages 339-345

Conclusions of these organisations support the continued growth in the use and acceptance of hydrocarbon refrigerants.

Scientific papers published by various organisations in Australia and overseas, repeatedly attest to the efficiency and safety of hydrocarbon refrigerants across a wide range of applications.

Great Heat Conductors
Hydrocarbons are also 50% more efficient conductors of heat than fluorocarbons.

In practical terms this means that the hydrocarbon molecule rejects heat faster than a fluorocarbon molecule.

For example, a Coca Cola or Pepsi drink cabinet which uses HyChill Minus 30 hydrocarbon refrigerant instead of HFC R134a, chills the cans to the desired temperature approximately 15% to 30% faster. In the summer time with higher volume store traffic, this is a definate advantage for the store owner, as well as for the manufacturer of the products being sold.

Use Less Gas
HyChill hydrocarbon refrigerants have a unique advantage, each kilogram of hydrocarbon refrigerant replaces 3 kilograms of fluorocarbon refrigerant, so you only require a third of the refrigerant by weight.

THE MARKET

Not only are HyChill's products more efficient and cost effective, but they also perform even better than the current market place alternatives. HCFC's and HFC's were developed to replace CFC's, but still contain blends of gases with a high Global Warming Potential. In general, they have been found to be poor substitutes under extreme conditions.

Originally, chemical companies developed HFC refrigerants as replacements for CFC's in an attempt to address the protection of the ozone layer. However, the high contribution of HFC's to global warming, coupled with unacceptable emissions of greenhouse gases released during manufacture, have made it imperative to phase them out as soon as possible.

In general, HFC refrigerants were found to be a poor substitute for CFC refrigerants, as extensive modifications to, or replacement of, existing systems were necessary to facilitate their use. This costly exercise was called retrofitting. Furthermore, HFC's were found to be poor performers under extreme conditions.

As these original HFC gases were found to be unsuitable in many refrigeration applications, it then became necessary to create a large number of HFC/HCFC combinations and other blends.

The importance of hydrocarbon refrigerants had been extolled by Greenpeace under the name "Greenfreeze Technology" for more than twenty years. As each application for alternative refrigerants was properly studied, it was found that a hydrocarbon refrigerant was available as the perfect alternative. Often, no changes to system design were required.

As a result, in 1991, Foron, a minor German manufacturer of refrigerators, was sponsored by Greenpeace to develop a small refrigerator, which utilized the best possible solutions for foam expansion and in the refrigeration system. This project advanced very quickly in the face of a great deal of obstruction by fluorocarbon refrigerant manufacturers and distributors.

In August 1992, the German mail order company "Neckermann" placed an initial order with Foron for 20,000 Greenfreeze refrigerators. Within three months, the quantity on order exceeded 50,000 units.

By the end of 1993, after enthusiastic acceptance of Foron "Greenfreeze Technology" at Europe's most important homewares exhibition, most of Germany's major refrigerator manufacturers announced that their production lines would adopt hydrocarbon technology as a matter of urgency.

By 1996, almost 100% of refrigerators made for the German market were designed to utilise "Greenfreeze Technology".

It's no surprise therefore that an increasing number of refrigeration systems are being charged with HyChill hydrocarbon refrigerants. The combination of first class products and environmental responsibility has propelled HyChill to grow in demand - from distributors and suppliers, to technicians and consumers.

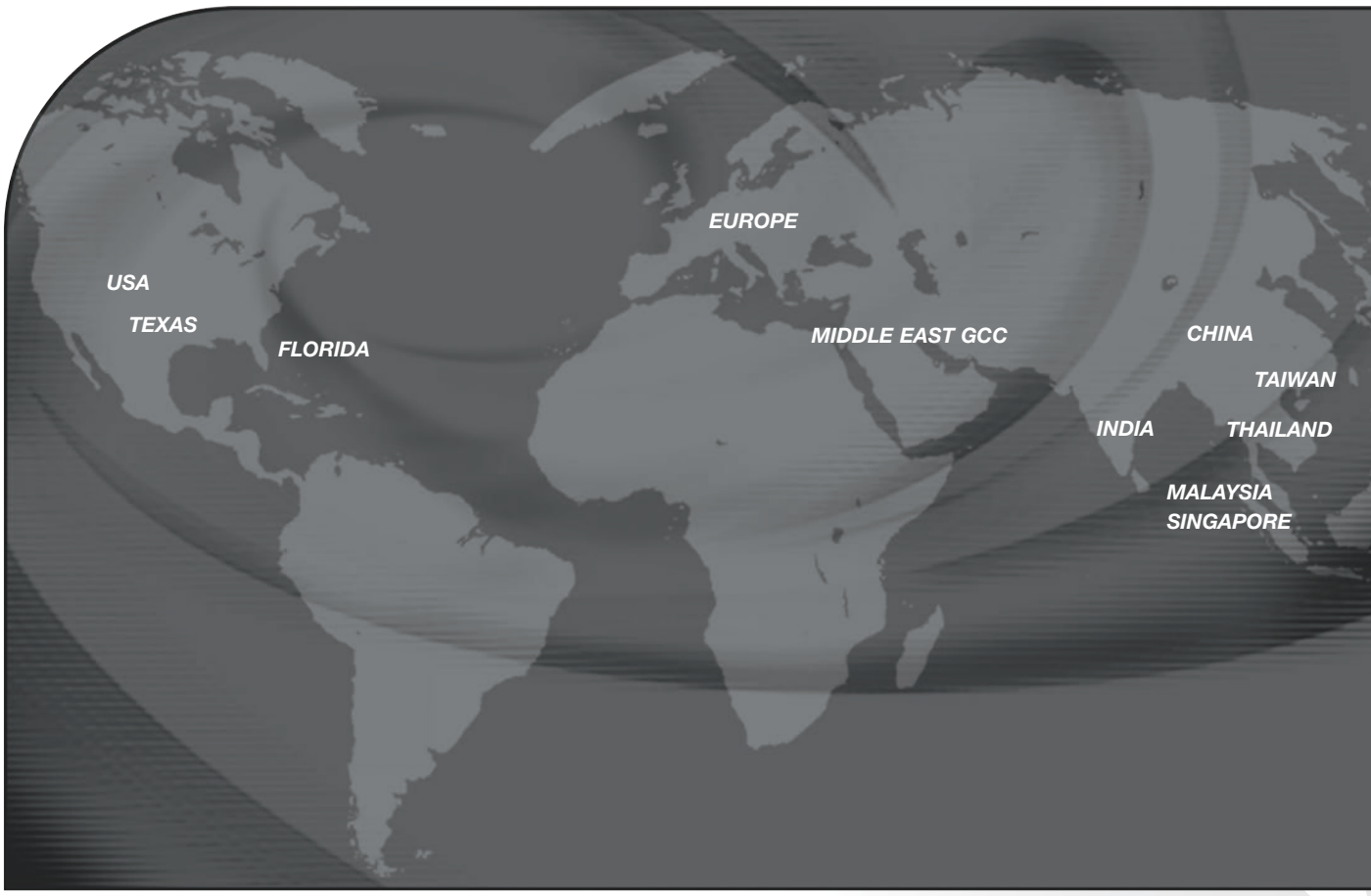
EXPORT

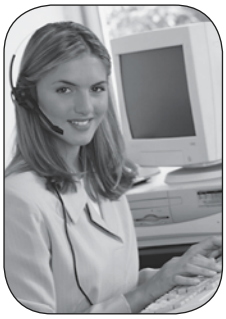
Utilizing a strong network of distributors, HyChill trades with countries from every corner of the globe and can supply in cylinders or bulk containers.

Implementing advanced technologies with quality and attention to detail that enables HyChill to present its service to the rest of the world. HyChill will deliver its products to any destination, in an effort to bring to the world the very best in high quality, advanced hydrocarbon refrigerants which help to save our environment and reduce energy consumption.

DISTRIBUTION

HyChill's unique production process, combined with an accomplished distribution network enable HyChill to maintain a leading position for supplying hydrocarbon refrigerants. The customised process allows high volume production of quality product, and every batch is tested to stringent standards. All orders are processed and packed in-house for distribution using efficient distribution systems. No matter where you are located, HyChill can supply top quality natural refrigerants.





SUPPORT

What makes HyChill unique, apart from its range of products, is the standard of after-care support - that famous HyChill service. It's all about customer satisfaction!

Friendly staff and experienced representatives are on hand for advice and always ready to assist. Comprehensive information is readily available for both the trade and consumers. These include:

- Product information brochures and leaflets.
- Information Manual covering all technical requirements.
- Interactive CD Roms
- A comprehensive website covering everything from products, to environmental trends, research and technical data. Check out **www.hychill.com.au**

You can rely on HyChill to set new industry standards in total customer satisfaction.

HyChill
HYDROCARBON REFRIGERANTS

It's all about 'Customer Satisfaction'

When you service your customers' air conditioner with highly efficient Minus 30 hydrocarbon refrigerant from HyChill, you are enhancing the most important component of your business: 'Customer Satisfaction.'

Minus 30 refrigerant is a highly efficient heat transfer medium; it uses about 30% less energy to produce a faster result. On really hot days, Minus 30 will put a smile on your customers' face. Contented customers guarantee the growth of your business.

We supply product at an attractive price - it's easy to see that Minus 30 is the lowest cost alternative to HFC refrigerants when you are only required to use 1/3 of R134a's charge weight, or about 85% by volume.

Each standard 22 litre cylinder will hold 9kgs of Minus 30 as opposed to 20kgs for R134a, this means **you are only paying for 9kgs of refrigerant and not 20kgs**. Furthermore, each 9kgs of Minus 30 will charge 30 or more systems whereas 20kgs of R134a will only charge about 25 systems.

You can use your normal equipment; Minus 30 is suitable for all systems. It doesn't matter whether it is an old R12 system, or a new R134a system, Minus 30 is compatible with all oils, O Rings, Seals and Gaskets. We highly recommend the use of modern service equipment, scales and diagnostic tools, they save time and money, and, they help to build your customers' confidence. We also recommend HyChill SRO 500 Synthetic Refrigerant oil, in systems and in your vacuum pump. It is non hygroscopic and is compatible with all refrigerants.

Old systems need to be serviced with a complete understanding that a "gas-up" will not fix faults! Your diagnostic skills are so essential. If you have a system, which just won't work, call us, if we don't know the answer we will research it for you, quickly! If you are unfamiliar with hydrocarbon refrigerants, we would appreciate you ringing for advice. Meanwhile, a free information manual is available, please indicate on your order if you require copies, or just phone us and we will mail one to you. A refrigerant charge weights list is avaiable for most systems.

Your goal is the same as ours, and the desired outcome is identical:

'Customer Satisfaction'

HyChill Refrigerants, the Natural Alternative

Minus 30 - PRODUCT DETAILS

High Efficiency Medium Temperature Hydrocarbon Refrigerant

- **Available in 4.5kg, 9kg cylinders and 300g cans**
- **Applications:** - Vehicle Air Conditioning
  - Refrigerated Containers and Transports
  - Domestic Refrigerators and Freezers
  - Drink Dispensers
  - Supermarket Cool Units and Displays
  - Domestic Air Conditioning Systems

Minus 30 is a blend of R600a and R290; two naturally occurring hydrocarbon refrigerant gases and is perfect for use in automotive air-conditioning systems and in refrigeration applications.

Minus 30 is derived from a uniquely pure natural gas source, and manufactured to the strictest quality controls.

Minus 30 is efficient and safe to use, requiring no modification to air conditioning systems and minimal modification to most refrigeration systems.

Minus 30 ensures exceptional energy efficiency, dispersing heat much more effectively than fluorocarbon equivalents.

Substantial cost savings for long term operation are achievable by replacing fluorocarbon refrigerants with Minus 30.

Safe, natural, and environmentally benign, the HyChill range of natural organic refrigerants is suitable for a wide range of air conditioning and refrigeration applications.

Since no retro-fitting is required, HyChill refrigerants are the prefered "drop in" solution for systems which previously used gases such as CFC R12 and HFC R134 and others.

Additional Information

Product Composition
- High Purity Hydrocarbon Refrigerant
- Precision Propane/Isobutane blend
- Cylinder has a liquid withdrawal valve (upright position labelled)
- 9 kg cylinder will charge up to 40 cars
- Packed in a cardboard box with information kit containing refrigerant identification labels, material safety data sheet and other usage guidance information.

Product Characteristics
- Superior heat rejection – gives better condenser heat exchange performance
- 30% by weight required of recommended fluorocarbon refrigerant charge or refer to charge weight section.
- Digital scales recommended – they save a great deal of time and also help to prevent refrigerant wastage.
- Minus 30 is compatible with any refrigerant lubricant, however we strongly recommend a system flush and use of SRO500 oil in all systems

Effect on Systems
- Lower Head Pressures reduce load on compressor
- Less heat at compressor
- Less engine drain at idle and when running
- Positive liquid head at TX valve or restrictor
- Quicker pull down temperature at vent
- Lower vent temperature at all times
- No upgrading to existing processing equipment required.
- No change to repairers procedures while installing

HyChill HYDROCARBON REFRIGERANTS

A GUIDE TO AIR CONDITIONING SERVICE AND DIAGNOSIS

The following pages are designed to assist in the step by step servicing and diagnosis of air conditioning systems.

SAFETY PRECAUTIONS

Refrigerants have a very low boiling point. Extreme care must be taken when they are being handled. Always observe the following safety precautions:

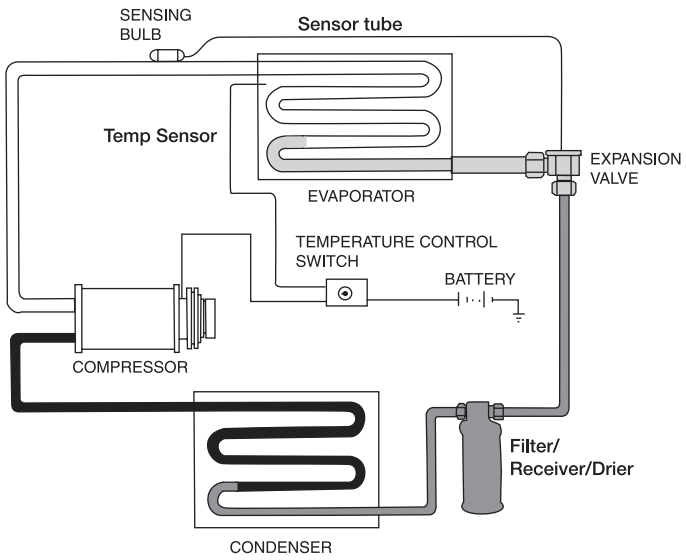
- Always wear eye protection
- Wear gloves
- Don't allow liquid refrigerant to contact the bare skin, as this can cause frost bite
- Don't heat containers of refrigerant
- Provide adequate ventilation when charging or recovering refrigerant as they are heavier than air
- Use caution when steam cleaning around A/C components as hot water on the pipes and tubing could cause damage due to thermal expansion of the refrigerant contained within them
- Avoid breathing refrigerant vapour
- If pumping refrigerant into a cylinder, do not allow the cylinder to be filled to more than 80% of its capacity, as the remaining 20% is necessary to allow for any thermal expansion of the refrigerant
- Always recover all fluorocarbon refrigerants

PREPARATION

The following preliminary checks should be carried out prior to any service or diagnosis of an air conditioning system:

- Check for visible damage or chaffing of the hoses
- Ensure the condenser fins are not blocked with debris such as insects, leaves etc. and that the fins are straight
- Ensure that the condenser fan operates and runs in the correct direction
- Check that the engine and radiator are at the correct operating temperature and are not overheating
- Inspect the drive belts for damage and correct tension
- Ensure that the engine viscous fan engages at the correct temperature.
- The compressor should cycle on and off
- Make sure the evaporator drain hose is not blocked
- The heater is turned off and in the full cold mode position
- The air mix door is fully closed
- A/C switch fully illuminates when engaged
- There are no vacuum hose leaks
- The dash vents should open and close fully
- There must be no air leaks between the evaporator case and the heater case
- The blower fan should be operational on all speeds
- Check for any evidence of refrigerant leakage and oil staining at components and connections

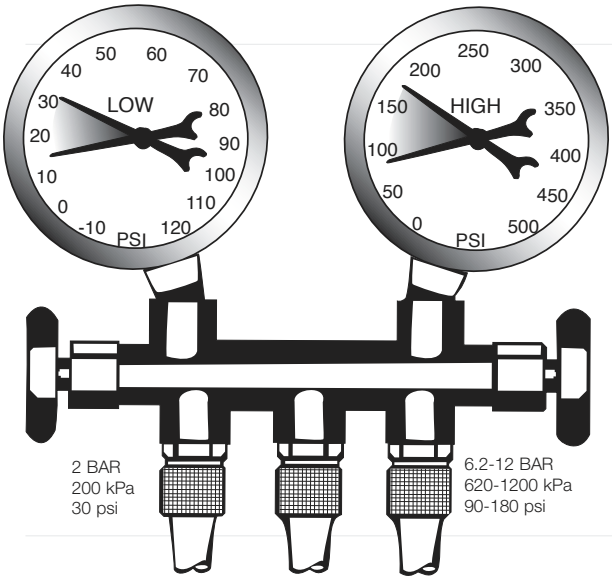
HOW A SYSTEM SHOULD OPERATE



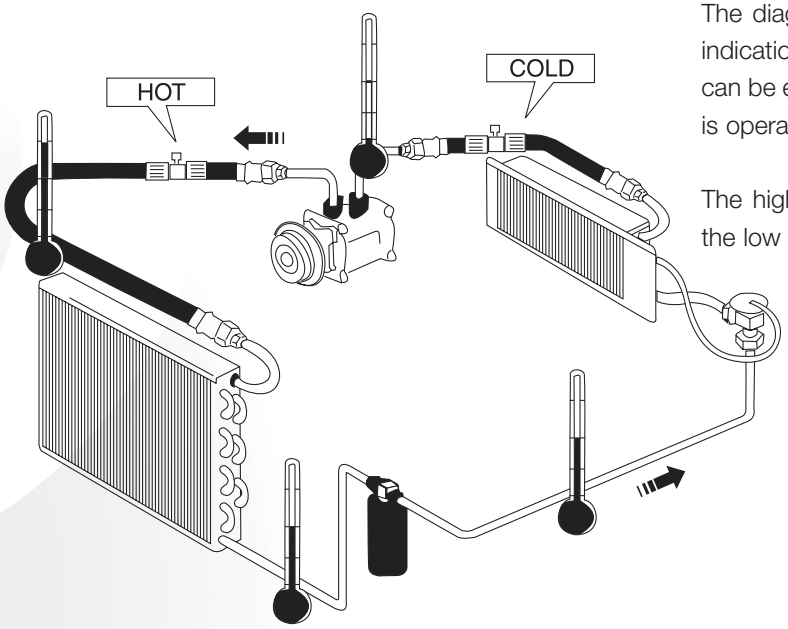
LEGEND

HIGH PRESSURE GAS
HIGH PRESSURE LIQUID
LIQUID TO GAS PHASE
LOW PRESSURE GAS

Hot
Cold



The gauge readings for Minus 30 refrigerant should be approx 150kPa (20 psi) on the low side, and 620-1200kPa (90 to 180 psi) on the high side, depending on the ambient temperature, good condenser, air flow and an suitably sized condenser - these items contribute to variations in the high pressure gauge reading. On larger commercial systems, pressures can be much lower.



The diagram to the left will give an indication of the temperatures that can be expected from a system that is operating correctly.

The high side will be hot to touch, the low side will be cold.

HyChill HYDROCARBON REFRIGERANTS

EVACUATION AND CHARGING PROCEDURE

PERFORMANCE TESTING (GENERAL)

1. Park vehicle in a shaded area. Take note of ambient temperature.

2. Open both front windows and bonnet.

3. Connect both high and low pressure service hose coupling valves to the system filling ports.

4. Open all dash louvres and adjust to the straight ahead position.

5. Insert thermometer probe approximately 50mm into the centre vent louvre.

6. Set the controls to:

A. Recirculate air position (use fresh air position on cold days when charging)
B. Maximum cooling
C. A/C on.

7. Start engine, bring engine speed to 1700 RPM then allow pressure gauge needles to stabilise.

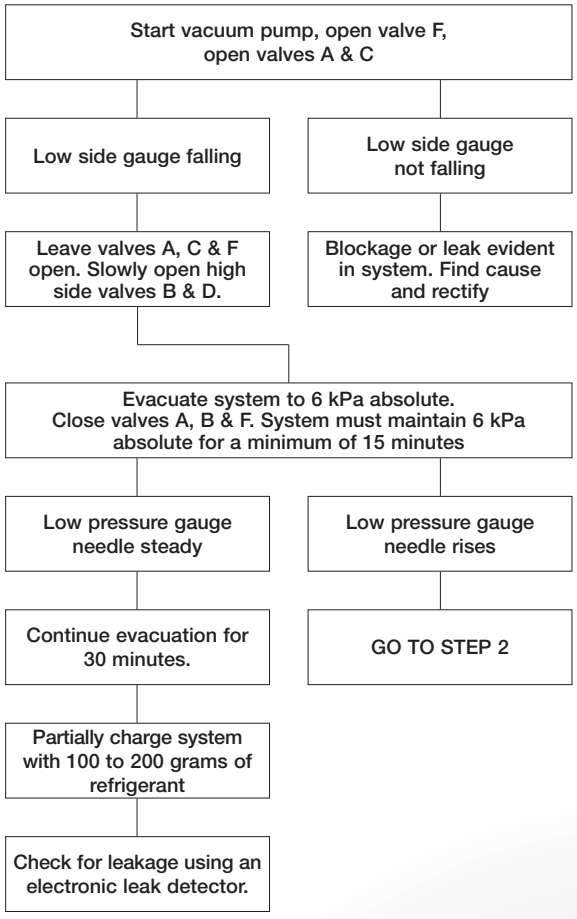
8. Take pressure and temperature settings. Compare these to the manufacturers performance charts found in the appropriate workshop manuals.

Note: Only take pressure and temperature readings when the compressor is engaged.

The performance test described here puts increased load on the A/C system. If the A/C system can operate to specification under this load, then it should have no problems maintaining a low centre vent temperature under normal driving conditions when the windows and bonnet are closed and the blower speed may be slower.

In hot weather when the engine temperature is normal, hot air from the engine bay can enter the fresh air intake and load the system. This will raise the temperature of the dash outlet air by up to 10ºC.

STEP 1 - EVACUATION



Recover refrigerant from system, open valves A, B, C, D, E & H. After the recovery procedure close valve E. Open valve F and continue the evacuation procedure for a minimum of 15 mins then close valves A, B & F. Turn pump off. (Refer Fig. 1)

Fig. 1

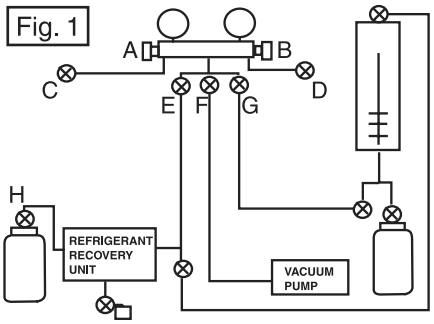
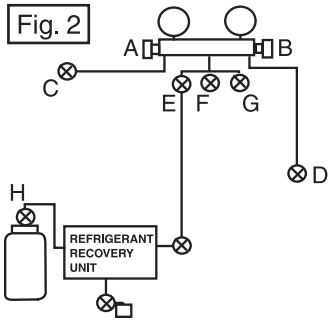


Fig. 2



NOTE: ⊗ Indicates stop tap or valve - fit these whenever a hose has to be removed

LEGEND

A Low side gauge valve
B High side gauge valve
C Low pressure a/c sys connection
D High pressure a/c sys connection
E Recovery system
F Vacuum pump
G Refrigerant supply
H Refrigerant recovery unit

STEP 2 - LEAK TESTING

Partially charge system with 100 to 200 grams of refrigerant through high side filling hose.

Locate leakage using soapy water or a leak detector. Check on the underside of all fittings and components.

Recover refrigerant from system open valves A, B, C, D, E & H. (Refer Fig. 1)

Repair leak source

Continue with evacuation and charging procedure as per steps 1 - 3.

STEP 3 - CHARGING SYSTEM

Warning: never run compressor without refrigerant in system as the compressor relies on refrigerant/oil flow. Any oil displaced during the refrigerant recovery process must be replaced in the system before charging can commence. The R134a system uses P.A.G. (Polyalkylen glycol) lubricating oil. Use specified oil type or HyChill SRO 500.

Warning: never charge system through the high side with the compressor running. (Which is not possible anyway)

Open high side valves B, D & G. Without exceeding the specified amount, allow as much refrigerant as possible to enter system

Watch to see if low side gauge rises. If not, the TX is shut and will need replacing.

Close valves B & D. Rotate compressor front plate 12 revolutions to ensure no liquid is trapped in the compressor

Start engine, set to fast idle. Activate A/C switch. Set controls to maximum cooling and high fan speed.

Open low side valves, A & C slowly and complete the charging process (If required).

Caution: Do not allow more than 275 kPa to register on the low side gauge during charging.

Close all valves and taps. Remove high and low filling hoses, make sure valves C & D are closed. Connect high side filling hose to recovery unit inlet side. Open valves A, B & D. Switch on recovery machine and remove all refrigerant from filling hoses. (Refer Fig. 2)

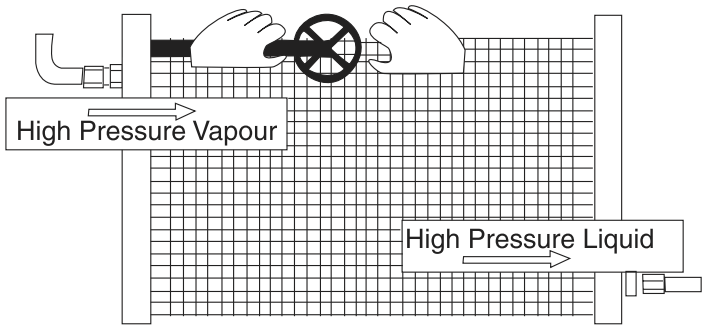
Carry out performance testing. Refer to appropriate workshop manual for specifications.

HyChill HYDROCARBON REFRIGERANTS

DIAGNOSTIC TIP - CHECKING FOR A BLOCKAGE IN THE CONDENSER

A change of state, where high pressure vapour forms into a high pressure liquid during the movement through the condenser takes place within approximately the first 1/3 of the condenser. With this change of state a slight temperature change takes place. This will vary depending on ambient temperature.

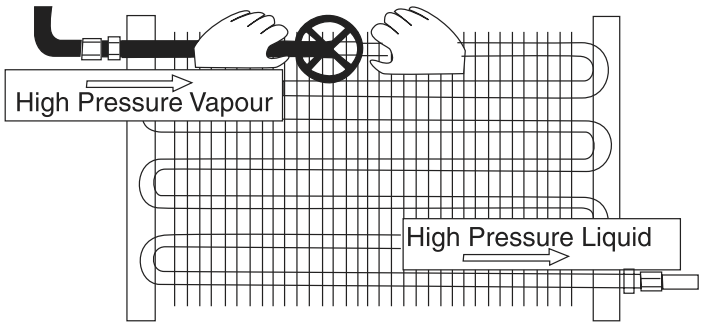
Using your finger, follow the tube(s) of the condenser (avoid burning your skin), you should be able to feel where the change takes place. This change will be quite subtle, however if you feel the difference in temperature before approximately the first 1/3, a blockage may be present.



Parallel Flow Condenser

With the parallel flow design condenser, refrigerant flows through more than one tube, so the possibility exists that the condenser will operate efficiently in lower ambient temperatures even if one or more of the tubes are blocked. Problems such as poor performance and excessive discharge pressures may not be apparent until the ambient temperature increases and greater refrigerant flow is required.

When the system is operating efficiently, the entry to the condenser will be quite hot and the liquid outlet will be just warm.



Tube Flow Condenser

WHY DO COMPRESSORS FAIL?

In most cases the reason you are fitting a reconditioned and guaranteed compressor is that the old or original compressor has "GONE DOWN", therefore you must ask yourself why did this happen?

Compressors do not fail for unexplained reasons so be assured that if you fit a compressor without answering the "WHY" question and without following the correct installation procedure this compressor will also "GO DOWN" causing you unnecessary losses in both time and money. So, why did the old unit fail?

The three most likely causes for compressors to seize are:

1. EXCESSIVE HEAD PRESSURE	2. LACK OF OIL	3. LACK OF REFRIGERANT (COMPRESSOR OVERHEATS)
In the case of excessive head pressure the three reasons for this are: **BLOCKAGE IN SYSTEM** - Check dryer, T.X. Valve, Condenser (internally) **OVERCHARGE IN THE SYSTEM** - Some compressors are extremely susceptible to this **OVERPRESSURE IN THE SYSTEM** - Inadequate car cooling system, clogged condenser fins (external), defective thermo fan or fan clutch, excessive moisture in system, a cocktail of refrigerants.	In the case of lack of oil the two reasons for this are: **SYSTEM BLOCKAGE** - restrictive flow of oil back to the compressor (i.e. tx valve, receiver/dryer, condenser, freezing evaporator) **SYSTEM LEAK** - allowing the oil to escape from the system.	Slow leaks allow the system to run with low liquid supply to tx valve. The suction return gas to the compressor is not cold enough to cool the compressor parts internally. Shaft seals harden and leak, oil deteriorates and metal parts fail.

Once you have found and rectified the reason for the old compressor failure, follow this procedure for the installation of the new unit to ensure trouble free running.

1. FLUSH THE SYSTEM 2-3 TIMES WITH **HyChill ECO-FLUSH**

It cannot be stressed strongly enough that if a compressor has had a burnout depositing sludge and debris through the system, this sludge will simply work its way back to the compressor if it is not removed.

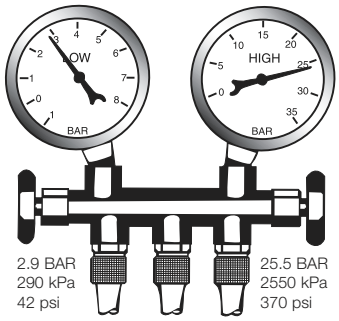
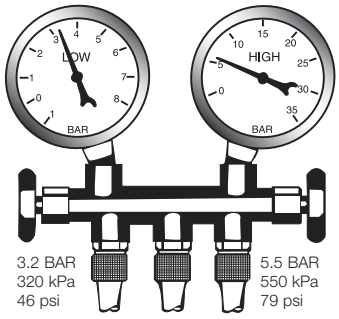
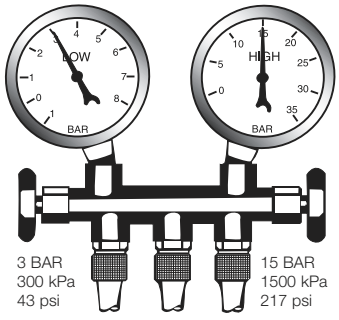
2. REPLACE T.X. VALVE

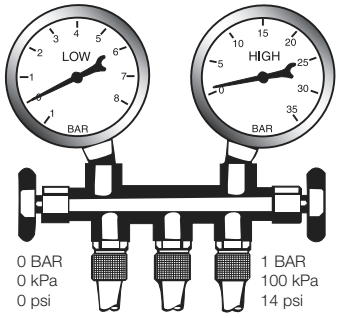
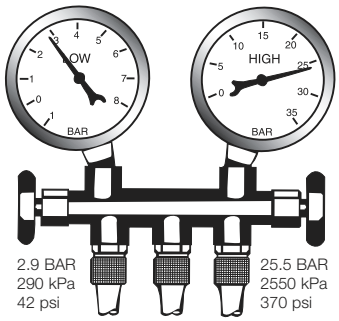
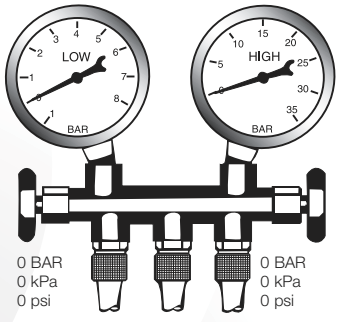
3. REPLACE RECEIVER DRYER

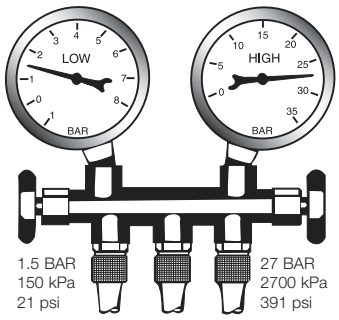
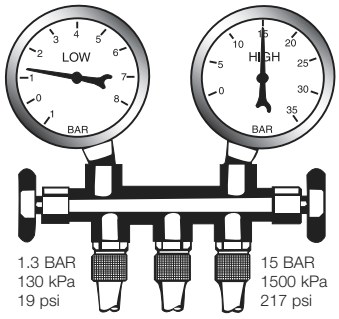
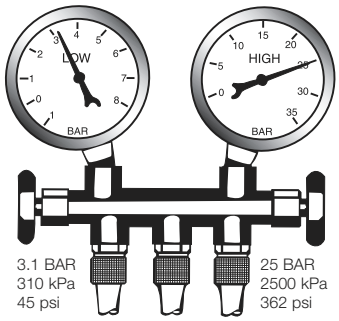
4. EVACUATE SYSTEM FOR CHARGING AND TESTING

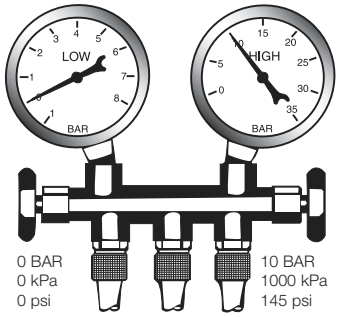
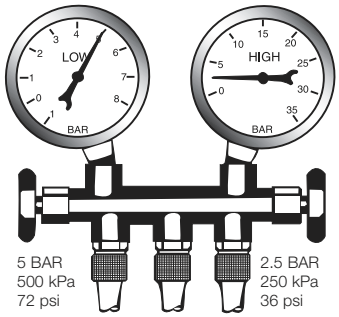
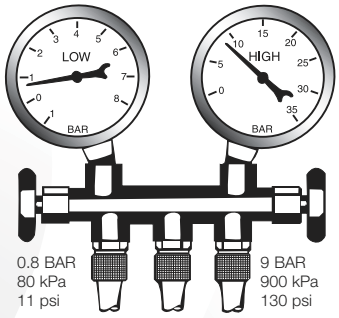
- **When compressor oil is replaced it should match the refrigerant to be used.**
- **HyChill SRO 500 lubricant is compatible with all refrigerants.**
- **HyChill Minus 30 Refrigerant is compatible with most commonly used oils.**

GAUGE AND SYSTEM DIAGNOSIS

PROBLEM	CONDITION	CAUSE
 **Excessive air (non condensables)** (CCTXV or TX valve system & CCOT or orifice tube system)	**Low side gauge:** High **High side gauge:** High **Discharge air:** Slightly cool **Note:** Low side pressure gauge needle does not fluctuate when compressor cycles On and Off.	• Large amounts of air and moisture in system caused by insufficient evacuation time or no evacuation time after repairing or servicing the system. • Leaking components within the system allowing moisture and air to enter. • Compressor valve plate damaged
 **Compressor malfunction** (CCTXV/CCOT system)	**Low side gauge:** High **High side gauge:** Low **Discharge air:** Warm **Compressor:** Noisy **Discharge hose:** Cool	• TX valve blocked or jammed shut
 **Compressor control valve malfunction** (Harrison V5 variable stroke compressor)	**Low side gauge:** Higher or lower than control point pressure **High side gauge:** Normal **Discharge air:** Cool only if above control point **Evaporator:** Freezes up if too far below control point **Note:** Refer to workshop manual for low side control point pressure	• Compressor control valve faulty or incorrect valve rating used. These valves are stamped with a letter code on the valve body indicating the pressure control point for the low side of the system. Eg. Code "Y" Y = 290 kPa (absolute) = 160-200 kPa (low gauge reading). Note: Refer to appropriate workshop manual.

PROBLEM	CONDITION	CAUSE
 **Orifice tube blocked** (CCOT system)	**Low side gauge:** Low to vacuum **High side gauge:** Low **Discharge air:** Slightly cool **Orifice tube:** Frost build up **Low pressure switch:** Deactivated	• Orifice tube filter screen blocked with debris such as aluminium particles.
 **Expansion valve (TX) remains open** (CCTXV system)	**Low side gauge:** High **High side gauge:** High **Discharge air:** Warm **Suction:** Sweating or frost build up	• Expansion valve (TX) jammed open and not modulating, causing flooding of evaporator with refrigerant. • This is normally related to incorrect positioning of temperature sensing bulb or foreign material and moisture entry causing rust formations. • Or old and failed TX valve.
 **Expansion valve (TX) remains closed** (CCTXV system)	**Low side gauge:** Low to vacuum **High side gauge:** Low **Discharge air:** Slightly cool **Expansion valve:** Sweating or frost build up	• Expansion valve (TX) jammed closed, insufficient refrigerant flow to suction side of the compressor. • This is normally related to the TXV sensing bulb malfunction, disconnected from tube, foreign material in TXV or moisture entry causing rust formations.

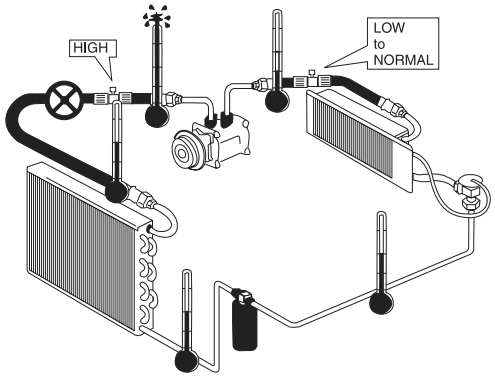
PROBLEM	CONDITION	CAUSE
 **Condenser malfunction or overcharge** (CCTXV/CCOT system)	**Low side gauge:** Low to normal **High side gauge:** High **Discharge air:** Warm **High side tubes:** Very hot **Compressor clutch:** Could continually cycle on the high pressure switch	• Refrigerant overcharge • Engine or condenser fan not operating • Condenser fins clogged with debris • No sealing foam between condenser and radiator • Obstruction in front of condenser eg. bullbar, insect screen • Fan belt slippage • Radiator overheating
 **Temperature control switch (de-icing control)** (CCOT system)	**Low side gauge:** Low to normal **High side gauge:** Normal **Discharge air:** Very cold then goes warm **Evaporator:** Freezes up **Air flow:** Restricted when evaporator freezes up or; compressor cycles On and Off too fast.	• Faulty thermostatic switch • Reset thermostat to cycle clutch out at 4ºC - 6ºC.
 **Orifice tube bypass** (CCOT system)	**Low side gauge:** High **High side gauge:** High **After orifice tube:** Warm **Accumulator:** Warm	• Refrigerant bypassing the orifice tube. • "O" rings on orifice tube damaged or missing.

PROBLEM	CONDITION	CAUSE
 **Refrigerant loss** (CCOT system)	**Low side gauge:** Low **High side gauge:** Low **Discharge air:** Cool **Accumulator:** Warm	• Refrigerant leak from system or normal refrigerant loss over a period of ten years in operation. • Refrigerant undercharge.
 **Electrical fault** (CCTX/CCOT system)	**Low side gauge:** High **High side gauge:** Low **Discharge air:** Warm **Compressor:** Not operating **Note:** Both high and low readings will be the same.	Electrical component open circuit; • Thermostat • Pressure switch • Clutch coil • Fuse • A/C switch • Blown switch • Wiring • Compressor drive belt missing No power to compressor clutch system. Operating pressure not normal. Equal approximately 500-600 kPa high and low side.
 **Restriction in high side of system** (CCTX/CCOT system)	**Low side gauge:** Low **High side gauge:** Low **Discharge air:** Slightly cool **High side tubes:** Cool and showing signs of sweating or moist build up after the point of restriction.	• Foreign material causing blockage between compressor outlet and evaporator inlet (high side). ie. Entry to compressor may be blocked. Receiver may be blocked by debris from compressor. • No or very little refrigerant flow to suction (low) side of compressor. • Note - Compressor noisy, fast cycling depending if the high pressure switch is before or after the restriction.

HyChill HYDROCARBON REFRIGERANTS

FEEL TEST

There will be times when the pressures registering on the gauges will not make sense. When this occurs, a handy diagnostic tip is to carry out a 'feel test'. Feeling the hoses and tubing may indicate the location of a possible blockage. The location of charge port will have to be considered when attempting this test, as the pressure gauge readings will vary, depending on which side of the charge port the blockage is located.

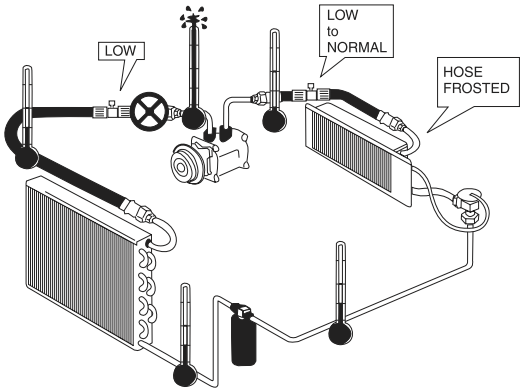


Blockage - high side (after charge port)

High side pressure: High

Low side pressure: Low to normal

- High pressure switch will not deactivate the A/C system, low pressure switch might.
- Compressor noisy
- High side hose very hot before blockage
- High side hose very cool to warm after blockage

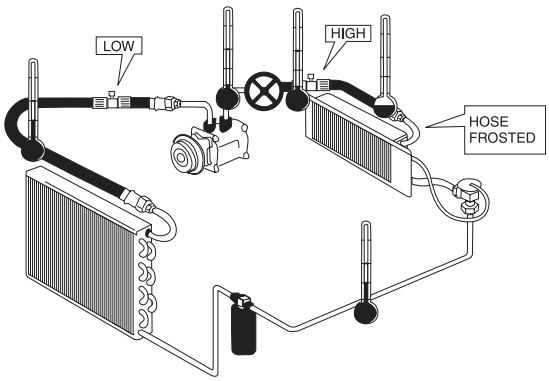


Blockage - high side (before charge port)

High side pressure: Low

Low side pressure: Low to normal

- High pressure switch will not deactivate the A/C system, low pressure switch might.
- Compressor noisy
- High side hose very hot before blockage
- High side hose very cool to warm after blockage

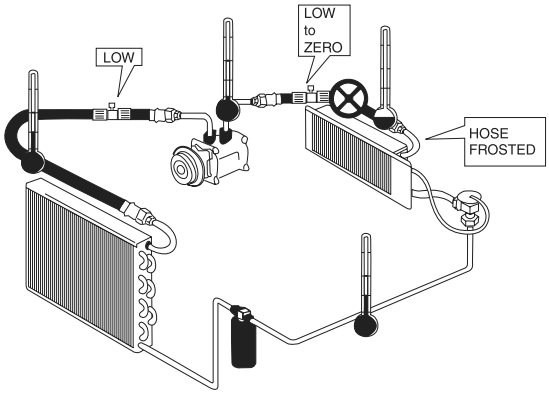


Blockage - low side (after charge port)

High side pressure: Low

Low side pressure: High

- Low pressure switch will deactivate the A/C system.
- Frosting of the low side hose/fittings before the blockage.

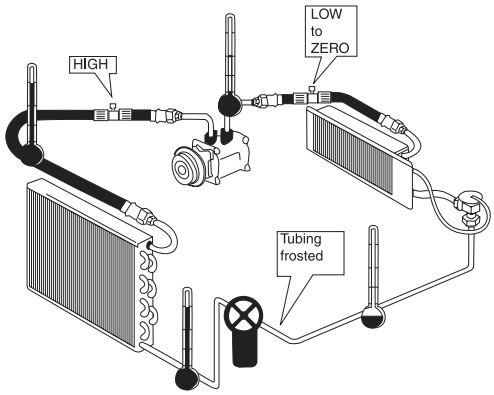


Blockage - low side (before charge port)

High side pressure: Low

Low side pressure: Low to vacuum

- Low pressure switch will deactivate the A/C system.
- Frosting of the low side hose/fittings before the blockage.

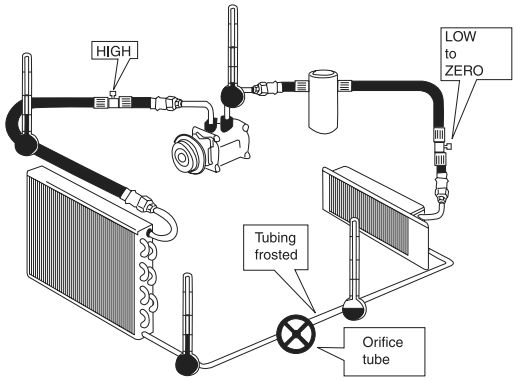


Blockage - receiver dryer

High side pressure: High

Low side pressure: Low to vacuum

- High pressure switch will deactivate the A/C system.
- If the blockage is in the receiver dryer itself, the outlet tube will be frosted.

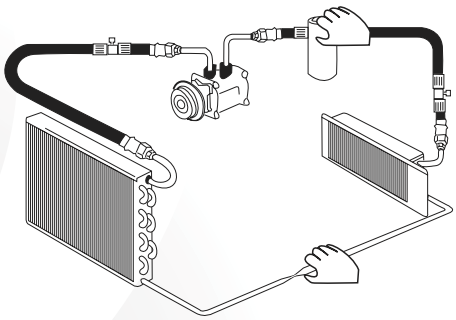


Blockage - orifice tube (CCOT system)

High side pressure: Low

Low side pressure: Low to vacuum

- Low pressure switch will deactivate the A/C system.
- Frosting of the tube after the orifice tube.



Checking refrigerant charge - CCOT system

Run the A/C system, place one hand on the outlet side of the orifice tube and one hand on top of the accumulator.

If the temperature of the accumulator is higher than the temperature after the orifice tube, then the refrigerant charge is not to specification. Add 150 gms and re-check.

PRODUCT COMPARISON CHART

	Minus 30	R134a	R12
Class	HC (HydroCarbon)	HFC (HydroFluoroCarbon)	CFC (ChloroFluoroCarbon)
Chemical Name	Isobutane & Propane $CH(CH_3)_3$ & C_3H_8	1,1,1,2,-Tetrafluoroethane CH_2FCF_3	Dichlorodifluoromethane CCl_2F_2
Formula	R-600a R-290	R-134a (100%)	R-12 (100%)
Boiling Point	-37.8˚C	-26.6˚C	-29.7˚C
Critical Temperature	112˚C	100.6˚C	112˚C
Toxicity	Low	Medium	Medium
Refrigerant Flammability (auto-ignition temperature)	Yes (~460˚C - ~470˚C)	No (~800˚C)	No (~1100˚C)
Lubricant Flammability (auto-ignition temperature)	Yes (~200˚C)	Yes (~200˚C)	Yes (~200˚C)
Refrigerant + Lubricant Flammability	Yes	Yes	Yes
Toxicity after ignition	Extremely Low	Very High	High
Global Warming Potential (20 years / 100years)	~0 / 3	3100 / 1300	8500 / 8500
Ozone Depletion Potential	None	None	Yes
Atmosphere Lifetime (Years)	<1	~16	~130
Cooling Performance @ 40˚C	Excellent	Marginal	Very Good
Energy Efficiency	High	Low	Medium
Power Consumption	Lower than R134a	High	Medium
Average System Charge by Weight	<300 grams	~750 grams	~900 grams