Building an air compressor intercooler for moisture removal

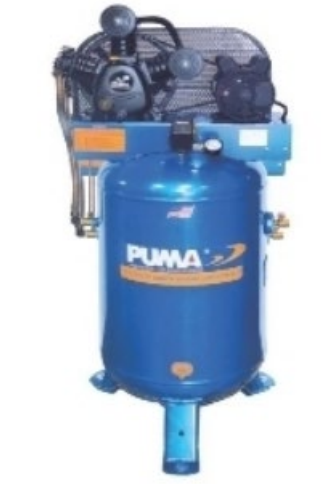
A common approach for producing dry compressed air is to lower the temperature of the compressed air thereby causing moisture to condense out of the air stream to be captured by a water separator. The moisture content of air is mostly affected by temperature. Cooler air cannot contain as much moisture as warmer air. Thus, many commercial dry air systems rely on passing the compressed air stream through a refrigerated space to reduce the amount of moisture the air can contain. The moisture then collects in the plumbing containing the airstream where it can be easily removed. The downside of these systems is initial cost, operating cost and capacity or CFM that the system can treat. A system capable of the volume of air used in media blasting, plasma cutting or paint/finish spraying costs thousands of dollars to purchase with high electrical demands to operate making it impractical for the small workshop.

Desiccant driers are capable of directly absorbing moisture from compressed air but have limited capacity. Even a fairly large 1 gallon desiccant drier system will fully load the absorbent media after just a few minutes of operation at the CFM needed for the uses listed.

The solution is to use an intercooler between the compressor outflow and the tank to significantly lower the temperature of the compressed airstream, causing the moisture to condense out, them pass the airstream through a water separator before entering the compressed air tank. This reduces rust formation in the tank, providing cleaner, drier air downstream. For maximum effect, the intercooler should have fan driven air passing through the condenser vanes to maintain maximum cooling.

On gas and belt driven electric compressors this can be easy to accomplish as the compressor is already equipped with a belt driven cooling fan to maintain airflow over the cylinder heads. By attaching an intercooler to the existing fan shroud, the existing fan provides airflow over both the intercooler condenser and the cylinder head(s).

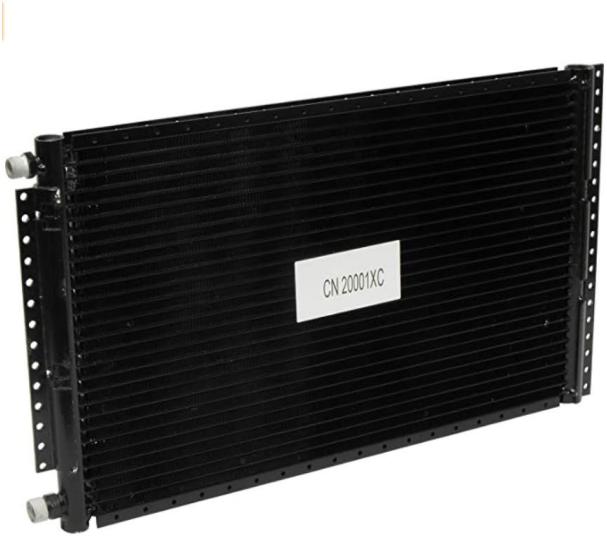
My compressor is a Puma TE3040V 3hp two stage belt drive 40gal unit. The intercooler build is not overly difficult. It requires low level plumbing skills, no electrical skills, and moderate problem-solving skills. The biggest challenge is finding the required fittings to adapt a condenser to the air fitting on the compressor and determining the order of assembly so that you do not end up with a final impossible to tighten fitting. Also, some pre-planning for service of components is helpful to determine where pipe unions should be used. Collecting the parts took about 3 days of hunting local supply stores and the internet. Assembly took about 1 day.



My goal was ultra-dry air for media blasting and specialty work. As such I also included a downstream ¾ gallon desiccant drier to ensure any moisture remaining in the airstream would be

removed. Provided I keep the pre-tank water separator from filling up and overflowing into the tank, the downstream desiccant drier has never required service and no moisture has accumulated in the tank. I did inadvertently leave the unit on while away for 2 weeks and the unit cycled multiple times per day due to a slow air leak at a terminal hose connection. The per-tank water separator filled up and overflowed into the tank. I drained about 2 tablespoons of water from the tank and the condition has never repeated. I check the tank weekly, but have never had any moisture drain from the tank since.

I recommend a high pressure, new, aluminum, parallel flow air conditioning condenser for your system. They are not expensive and are the heart of the build. It is not worth skimping on this part. Parallel flow condensers have much higher flow rates than traditional tube condensers but offer slightly less cooling. If your air demands exceed 3CFM I recommend parallel flow otherwise you may/may not meet your CFM requirements. I purchased a UAC brand model CN2001XC from Amazon for my condenser.



Universal Air Conditioner CN 20001XC A/C Condenser

Visit the UAC Store

★★★★★ 1 rating

Price: $38.04

Get $70 off instantly: Pay $0.00 ~~$38.04~~ upon approval for the Amazon Prime Rewards Visa Card. No annual fee.

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- Brand New, OE replacement: UAC branded Condenser Parallel Flow
- Premium ISO/TS 16949 quality; tested to meet or exceed OEM specifications
- Anti corrosive paint layer designed to resist damage and aging; brazed and mechanically bonded aluminum construction for OE durability
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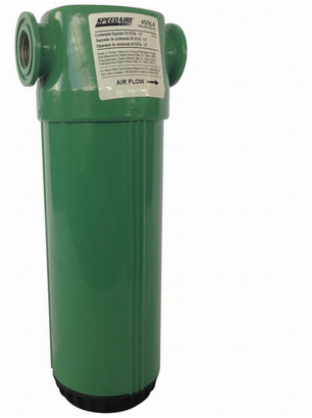
This unit lowers the temperature of my compressed air stream from 240^0F at the cylinder head outflow port to 75^0F at the condenser outlet with no loss in CFM or pressure. Amazing performance. From the condenser the compressed air stream goes to an ½" inlet inline air compressor water moisture separator. If you use your compressor 3x or more times per week, I recommend getting one with an auto drain. This will be the most expensive component of the build ranging from $90-$200. You want a bowl size (capacity) of at least 10 ounces. Ensure the unit meets or exceeds your compressor rated CFM and pressure. You can save money buying one with a bowl size of about ½ pint, but the flow rate may be an issue and the unit will fill rapidly resulting in overflow into your tank.



SPEEDAIRE

GRAINGERCHOICE

235 psi PSI Automatic Aluminum Pneumatic Condensate Separator

Item # **4GNL4**
Mfr. Model # **4GNL4**
UNSPSC # **40151610**
Catalog Page # **2590**

Country of Origin Turkey. Country of Origin is subject to change.

Features a centrifugal airflow pattern that helps remove bulk contaminants from the compressed air stream.
Low pressure drop. Separator has auto drain that automatically discharges condensate and dirt.

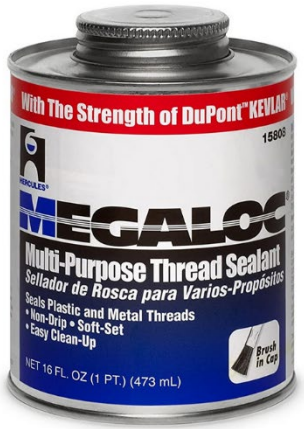
☐ Compare this product

You can attach the condenser directly to the fan shroud of the existing cooling fan (if your compressor is not equipped with a cooling fan, you can try running without cooling air flow and check performance or use an electric fan mounted to your condenser. This second option allows mounting the condenser in any location which may be useful in your shop. The fan will need to be manually switched on/off or wired into your compressor so that the fan activates when the compressor runs. This electrical work is beyond my expertise).

Here is the compressor with the condenser attached to the fan shroud. There are ¼" thick cork pads between the compressor shroud and the condenser body to reduce vibration and wear on the condenser. I had the cork from a previous project. Rubber would suffice. The condenser is held in place with small bolts using the mounting holes on the condenser and matching locations in the fan shroud. Washers prevent the bolts from pulling through the shroud.

To maintain CFM, I used all ½" galvanized pipe and fittings wherever possible. As the condenser is aluminum and will be operating in a moist environment, use only galvanized, aluminum, or steel fittings on the condenser. It is very tempting to use brass, but brass and aluminum in a moist environment cause rapid galvanic corrosion of the aluminum, your condenser, leading to pre-mature failure under pressure. It is more difficult to find these fittings, but worth the effort in longevity.

I recommend Oatey Hercules Megaloc thread sealant on all connections for a first time, air-tight fit.



Oatey 15808 Hercules Megaloc Multi-Purpose Thread Sealant, 16 Oz, Can, Blue, Liquid Paste, 473 ml, Bule

Brand: Oatey
★★★★☆ 17 ratings

Price: $24.57
Sale: $23.86 prime & FREE Returns
Discount Provided by Amazon. Details

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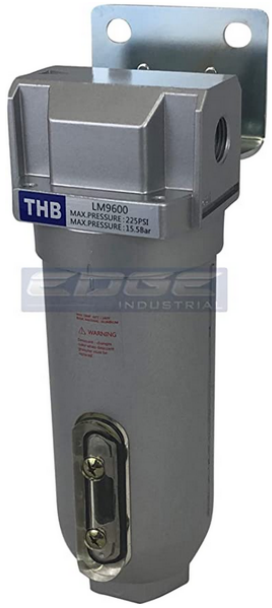
May be available at a lower price from other sellers, potentially without free Prime shipping.

Size	16 oz / 473 ml
Material	HAWA
Brand	Oatey
Color	Bule
Item Dimensions LxWxH	13.56 x 10.5 x 5 inches
Item Weight	1.35 Pounds

If you want to ensure the driest air possible, an inline down stream desiccant drier is a great addition. I have provided an example of one I believe would be adequate for most home shops. The one I have on my system is similar but no longer available.



EDGE INDUSTRIAL HEAVY DUTY IN LINE DESICCANT AIR DRYER WITH METAL BOWL, FOR COMPRESSED AIR, DRY AIR FOR PNEUMATIC TOOLS (3/4" NPT)

Brand: EDGE Industrial Desiccant Dryer

9 ratings

Price: $79.85 prime & FREE Returns

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Style: **3/4" NPT**

1" NPT	1/2" NPT	**3/4" NPT**
$79.85 prime	$79.80 prime	**$79.85** prime

- 3/4" HEAVY DUTY IN LINE DESICCANT AIR DRYER WITH METAL BOWL AND VISIBLE SIGHT GLASS.

From here it is only planning, plumbing, and patience to get a low operating cost, durable dry air system.

Let me know how your build goes or contact me with any questions at aPlaneLife@comcast.net.