

Refrigerating Engineers and Technicians Association

Introduction to the RETA Certification Exam CIRO Supplement Package

An introduction to the RETA CIRO Exam Supplemental Information Package

REVISED 05-22-2010

When you take the RETA exam, you bring the supplemental package we send you with your permit to schedule your exam test. If you are not familiar with what is in the supplement you'll have more difficulty answering the questions. The supplement package is available on the RETA website for you to download, print and preview prior to sitting in the exam room. The purpose of this document is to take you a little further in the "getting familiar with" the contents of the supplemental package.

On first look, you will see a page of formulas. This is good news to you because unlike the early certificatees you are not required to remember formulas and equations. The next section of the supplement contains illustrations from the RETA books or diagrams developed for the CIRO test. There are photographs and simple flow diagrams, a wiring ladder diagram followed by several illustrations of system information showing normal operating situations and in some cases abnormal situations. Following the system screens there is an MSDS sheet for ammonia. The last section of the supplement package is the full saturation table for ammonia and HCFC-22.

The answers to the questions posed in this document are not in this document. We are not publishing a "key" to this introduction. You might ask a chapter officer, or a knowledgeable co-worker what they think the answer is to the question posed. This is an introduction and you have access to the materials to determine the correct answer to the questions listed. You are expected to work out the answers and verify your response by researching the information in the RETA books. The questions asked within this document are formatted as "supply the answer" type instead of "multiple choice" type responses. This is to help you fully understand the information involved in answering a question from the RETA CIRO exam. If mathematics for refrigeration is a problem for you, RETA offers a "Mathematics for HVAC/R Technicians" publication in its library.

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- STEP #1: Download and print the entire CIRO supplement pdf file from the RETA website.
- STEP #2: Get your calculator. A scientific calculator is not necessary because all the math functions you need to do can be done long-hand if you had to.
- STEP #3: Get your books together so you can look things up as needed.
- STEP #4: Print this document and look at the last page. The information on this page is similar to the information screens found in the full supplement document.

The illustration selected has a “NORMAL” set of system values and an “ABNORMAL” set of system values. Questions will be asked from both sets of system values, however we will go completely through the NORMAL set before working on the ABNORMAL set. The ABNORMAL screen situations do not state how many months have passed between NORMAL and ABNORMAL conditions. Do not assume that the ABNORMAL conditions occurred overnight. There may be several months of operating time between the condition sets reviewed.

The objective of this supplement is to help you prepare yourself to sit for the CIRO examination. A CIRO operator demonstrates that they can:

- Determine the condition of the refrigerant at any place in the system by knowing how to use the information from instruments.
- Analyze the findings of the conditions and apply their knowledge to resolve, fix, adjust system components in order to achieve a better running condition.
- Determine the cost of operating under certain conditions – both in terms of dollars per hour or in power demand and consumption over time. Mathematics is involved.
- Go to a resource and look up information in order to apply that information to solve a problem or resolve an undesirable running condition.
- Think analytically, taking in data and using that input to deduce a correct answer.

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SAMPLE CIRO SCREEN 300 HP SCREW COMPRESSOR – NH3 NORMAL CONDITIONS			
SUCTION PRESSURE	32 PSIG	SCREW COMPRESSOR MOTOR AMPS	295 AMPS
DISCHARGE PRESSURE	154 PSIG	SCREW COMPRESSOR MOTOR VOLTAGE	480 VAC
OIL PRESSURE	55 PSID	SCREW COMPRESSOR SLIDE VALVE POSITION	100%
SUCTION TEMP	26°F	CONDENSER WATER SUMP TEMP	75°F
DISCHARGE TEMP	171°F	CONDENSED LIQUID TEMP	85°F
OIL TEMPERATURE	136°F	CONDENSER OUTLET PRESSURE	151 PSIG
OIL COOLER – OIL INLET TEMP	171°F	- THERMO SIPHON OIL COOLING - CONDENSER OUTLET NOT SUBCOOLED	
OIL COOLER – REFRIGERANT OUTLET TEMP	85°F		
NOTES: POWER FACTOR IS 0.86		MOTOR TYPE IS 3 PHASE	
MOTOR EFFICIENCY IS 93%		CONDENSER TYPE IS EVAPORATIVE	

SAMPLE CIRO SCREEN 300 HP SCREW COMPRESSOR – NH3 ABNORMAL CONDITIONS			
SUCTION PRESSURE	32 PSIG	SCREW COMPRESSOR MOTOR AMPS	339 AMPS
DISCHARGE PRESSURE	184 PSIG	SCREW COMPRESSOR MOTOR VOLTAGE	480 VAC
OIL PRESSURE	55 PSID	SCREW COMPRESSOR SLIDE VALVE POSITION	100%
SUCTION TEMP	26°F	CONDENSER WATER SUMP TEMP	75°F
DISCHARGE TEMP	192°F	CONDENSED LIQUID TEMP	95°F
OIL TEMPERATURE	154°F	CONDENSER OUTLET PRESSURE	181 PSIG
OIL COOLER – OIL INLET TEMP	192°F	- THERMO SIPHON OIL COOLING - CONDENSER OUTLET NOT SUBCOOLED	
OIL COOLER – REFRIGERANT OUTLET TEMP	95°F		
NOTES: POWER FACTOR IS 0.86		MOTOR TYPE IS 3 PHASE	
MOTOR EFFICIENCY IS 93%		CONDENSER TYPE IS EVAPORATIVE	

Use this information screen to answer the questions in the introduction to the CIRO supplement package document. Download and print the CIRO Supplement document from the website for saturation tables and formulas needed.

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USING THE NORMAL INFORMATION SET FROM THE 300 HP ILLUSTRATION OF THIS DOCUMENT:

1. What is the superheat at the compressor inlet?
2. What is the temperature differential between oil cooler oil inlet and oil outlet?
3. What is the temperature differential between oil cooler coolant outlet and oil outlet?
4. What is the superheat at the compressor outlet?
5. What is the theoretical discharge temperature of the compressor under these conditions?
6. What is the pressure drop from the compressor discharge to condenser outlet?
7. What is the excess pressure due to non-condensables in the "normal" system?
8. What is the condition of the refrigerant leaving the oil cooler?
9. How much horsepower is being developed by the compressor motor under the normal conditions? (answer to the nearest whole horsepower)
10. What is the instantaneous Kw demand developed by the compressor motor under normal conditions? (answer to the nearest whole Kw)
11. If power is \$0.17 per kwh - how much does it cost to run the motor under normal conditions for an hour?
12. If power is \$0.17 per kwh - how much does it cost to run the motor under normal conditions for a day (24 hours)

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13.If power is \$0.17 per kwh - how much does it cost to run the motor under normal conditions for a week (24/7).

14.If power is \$0.17 per kwh - how much does it cost to run the motor under normal conditions for a 5000 run-hour year?

USING THE ABNORMAL INFORMATION SET FROM THE 300 HP ILLUSTRATION OF THIS DOCUMENT:

15.What is the superheat at the compressor inlet?

16.What is the temperature differential between oil cooler oil inlet and oil outlet?

17.What is the temperature differential between oil cooler coolant outlet and oil outlet?

18.What is the oil cooling coolant?

19.What is the superheat at the compressor outlet?

20.What is the theoretical discharge temperature of the compressor under these conditions?

21.What is the pressure drop from the compressor discharge to the condenser outlet?

22.What is the excess pressure due to non-condensables in the "abnormal" system?

23.What is the condition of the refrigerant leaving the oil cooler?

24.How much horsepower is being developed by the compressor motor under the abnormal conditions? (answer to the nearest whole horsepower)

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25. What is the instantaneous Kw demand developed by the compressor motor under abnormal conditions? (answer to the nearest whole Kw)
26. If power is \$0.17 per kwh - how much does it cost to run the motor under abnormal conditions for an hour?
27. If power is \$0.17 per kwh - how much does it cost to run the motor under abnormal conditions for a day (24 hours)
28. If power is \$0.17 per kwh - how much does it cost to run the motor under abnormal conditions for a week (24/7).
29. If power is \$0.17 per kwh - how much does it cost to run the motor under abnormal conditions for a 5000 run-hour year?
30. What is the excess cost per hour for running poorly?
31. What is the excess cost per day (24 hours) for running poorly?
32. What is the excess cost per week (24/7) for running poorly?
33. What is the excess cost when running 5000 hours (a year) poorly?
34. What would happen to the condenser sump water temperature if the fans were not running? (assume wet bulb temp is same as NORMAL conditions)
35. What would happen to the condenser sump water temperature if the water pump was not running? (assume wet bulb temp is same as NORMAL conditions)
36. What might happen to the condenser sump water temperature if the coils were scaled up significantly?
37. What might be going on that causes the higher condensing conditions?

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REFER to the MSDS in the supplement pdf

38. What is the STEL for ammonia?
39. List the seven category items found under the summary of Acute Health Hazards.
40. What conditions to avoid are recommended in Section X of the MSDS?
41. What is the Reportable Quantity stated in Section XV of the MSDS?
42. What section speaks to Exposure Controls and Personal Protection?
43. Is ammonia a carcinogen?
44. What sections of this MSDS have been changed from previous editions of the MSDS?

REFER to Figure 16 of the supplement pdf. This vessel is 3' in diameter and 10 feet in length. For all the following vessel questions treat the vessel as a simple cylinder even though you know there is a drop leg and nozzles and elliptical heads. Answer to the closest whole number (cubic feet, pounds, etc)

45. What is the internal volume of the vessel in cubic feet?
46. How many pounds of saturated ammonia vapor at -40°F will fit in the vessel?
47. How many pounds of saturated ammonia vapor at -20°F will fit in the vessel?
48. How many pounds of saturated ammonia vapor at 0°F will fit in the vessel?

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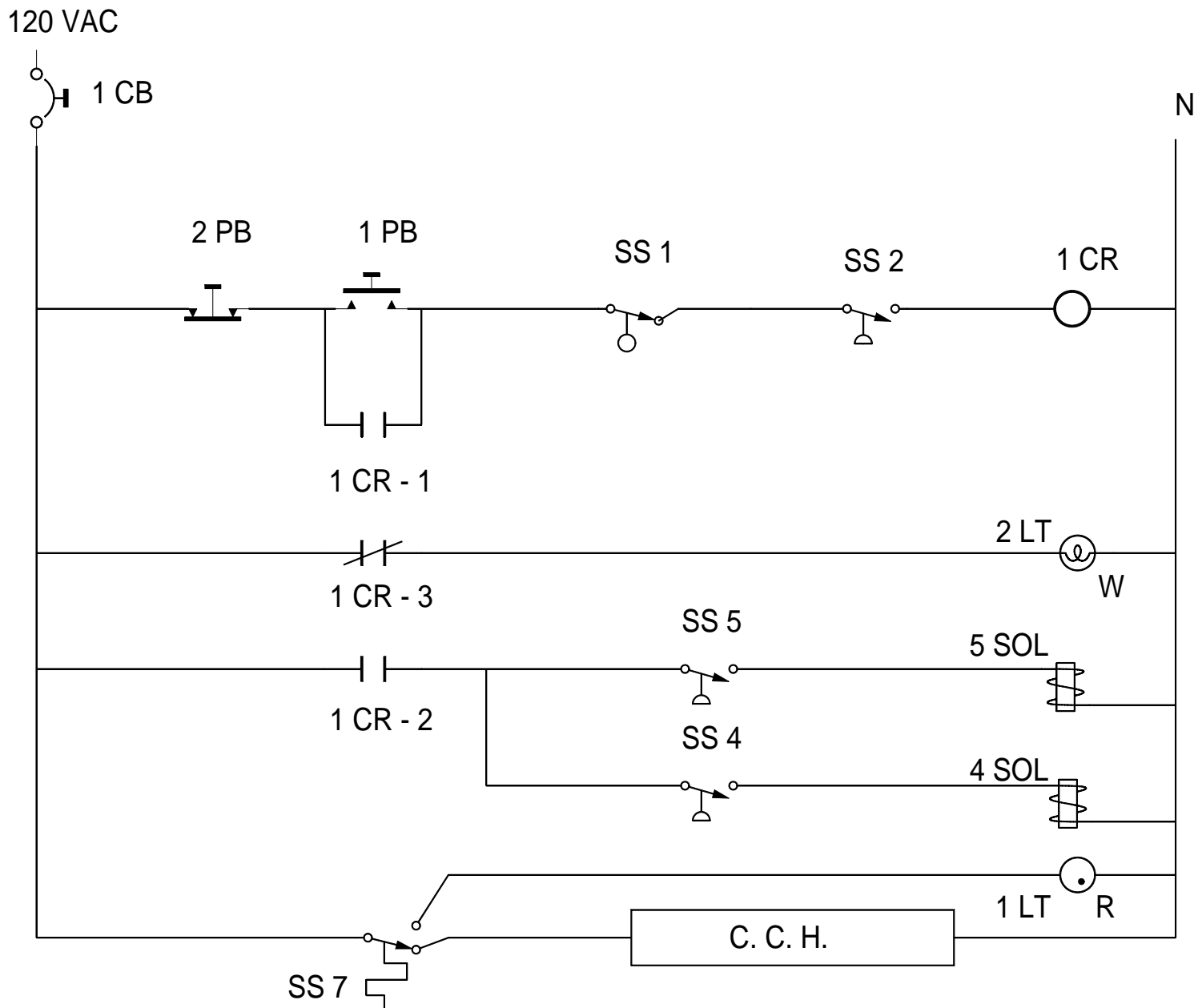
49. How many pounds of saturated ammonia vapor at +20°F will fit in the vessel?
50. How many pounds of saturated ammonia liquid at -40°F will be in the vessel when 30% full?
51. How many pounds of saturated ammonia liquid at -20°F will be in the vessel when 30% full?
52. How many pounds of saturated ammonia liquid at 0°F will be in the vessel when 30% full?
53. How many pounds of saturated ammonia liquid at +20°F will be in the vessel when 30% full?

REFER to electrical drawing example in this package.

54. How many neon lamps are on the drawing?
55. Is there a latching circuit on the drawing?
56. Which level switch closes on “low”?
57. What does 1CR do?
58. What switch is single pole – double throw?
59. What happens if 1CB trips?
60. When is 2LT illuminated?
61. What has to happen in order for 1CR to be energized?

The information that supports the questions listed above is found in:
IR-1 IR-2 IR-4 BE-1 BE-2

There are 24 system information screens in the supplement package. You are encouraged to look them over and apply the same question language to a selection of those of your choosing.



RETA - INTRODUCTION TO CIRO SUPPLEMENT LADDER DIAGRAM EXAMPLE

11-24-06