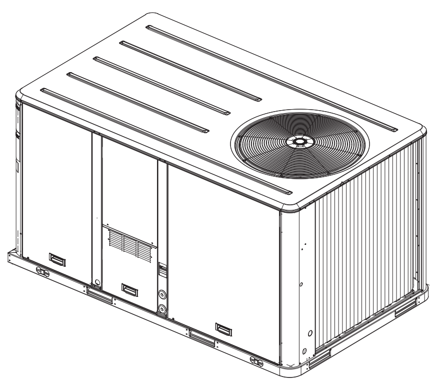
# Service Facts

## Packaged Rooftop Air Conditioners
## Precedent™ - Cooling and Gas/Electric
10 Ton Standard Efficiency Rooftop Units



| **Model Numbers** | TSC120F | YSC120F |
|---|---|---|

**⚠SAFETY WARNING**

**Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.**

July 2014

**RT-SVF28F-EN**

Ingersoll Rand

# Introduction

Read this manual thoroughly before operating or servicing this unit.

## Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

| | |
|---|---|
| **⚠WARNING** | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. |
| **⚠CAUTION** | Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices. |
| ***NOTICE*** | Indicates a situation that could result in equipment or property-damage only accidents. |

### Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

### Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

**⚠WARNING**

**Proper Field Wiring and Grounding Required!**

**Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.**

**⚠WARNING**

**Personal Protective Equipment (PPE) Required!**

**Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.**

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

**Failure to follow instructions could result in death or serious injury.**

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## Revision History

RT-SVF28F-EN (11 July 2014)

- Added Low Leak Economizer Factory and Field Installed Option

# Table of Contents

# General Data

**Table 1. General data -10 tons - standard efficiency**

| | 10 Tons |
|---|---|
| | **T/YSC120F3,4,W** |
| **Cooling Performance[a]** | |
| Gross Cooling Capacity | 119,000 |
| EER[b] | 11.3 |
| Nominal cfm/AHRI Rated cfm | 4,000/3,500 |
| AHRI Net Cooling Capacity | 113,000 |
| IEER[c] | 13.0 |
| System Power (kW) | 10.0 |
| **Compressor** | |
| Number/Type | 2/Scroll |
| **Sound** | |
| Outdoor Sound Rating (dB)[d] | 88 |
| **Outdoor Coil - Type** | Microchannel |
| Configuration | Full Face |
| Tube Size (in.) OD | 1 |
| Face Area (sq. ft.) | 20.77 |
| Rows/FPI | 1/20 |
| **Indoor Coil - Type** | Lanced |
| Configuration | Intertwined |
| Tube Size (in.) | 0.3125 |
| Face Area (sq. ft.) | 12.36 |
| Rows/FPI | 4/16 |
| Refrigerant Control | Thermal Expansion Valve |
| Drain Connection Number/Size (in.) | 1¾ NPT |
| **Outdoor Fan - Type** | Propeller |
| Number Used/Diameter (in.) | 1/26 |
| Drive Type/No. Speeds | Direct/1 |
| cfm | 6,800 |
| Motor hp | 0.75 |
| Motor rpm | 1,100 |
| **Indoor Fan - Type** | BC Plenum |
| Number Used/Diameter (in.)/Width (in.) | 1/19.7x15 |
| Drive Type/Number Speeds | Direct/Variable[e] |
| Motor hp (Standard/Oversized) | 3.75/— |
| **Filters[f]** | |
| Type Furnished | Throwaway |
| Number Size Recommended | (4) 20x25x2 |
| **Refrigerant Charge [g]** | |
| Pounds of R-410A | 5.5/4.2 |

**Table 1. General data -10 tons - standard efficiency**

| | 10 Tons |
|---|---|
| | **T/YSC120F3,4,W** |
| **Heating Performance[h] (Gas/Electric Only)** | |
| **Heating Input** | |
| Low Heat Input (Btu) | 150,000/105,000 |
| Mid Heat Input (Btu) | 200,000/140,000 |
| High Heat Input (Btu) | 250,000/175,000 |
| **Heating Output** | |
| Low Heat Input (Btu) | 120,000/84,000 |
| Mid Heat Input (Btu) | 160,000/112,000 |
| High Heat Input (Btu) | 200,000/140,000 |
| **AFUE % [i]** | |
| Low Heat Input (Btu) | 80 |
| Mid Heat Input (Btu) | 80 |
| High Heat Input (Btu) | 80 |
| **Steady State Efficiency %** | |
| Low Heat Input (Btu) | 80 |
| Mid Heat Input (Btu) | 80 |
| High Heat Input (Btu) | 80 |
| **No. Burners** | |
| Low Heat Input (Btu) | 3 |
| Mid Heat Input (Btu) | 4 |
| High Heat Input (Btu) | 5 |
| **No. Stages** | |
| Low Heat Input (Btu) | 2 |
| Mid Heat Input (Btu) | 2 |
| High Heat Input (Btu) | 2 |
| **Gas Supply Line Pressure** | |
| Natural (minimum/maximum) | 4.5/14.0 |
| LP (minimum/maximum) | 11.0/14.0 |
| **Gas Connection Pipe Size (in)** | |
| Low Heat | 3/4 |
| Mid Heat | 3/4 |
| High Heat | 3/4 |

(a) Cooling performance is rated at 95°F ambient, 80°F entering dry bulb, 67°F entering wet bulb. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Units are suitable for operation to ±20% of nominal cfm. Units are certified in accordance with the Unitary Air-Conditioner Equipment certification program, which is based on AHRI Standard 340/360.
(b) EER is rated at AHRI conditions and in accordance with DOE test procedures.
(c) Integrated Efficiency Ratio (IEER) is rated in accordance with AHRI Standard 340/360. The IEER rating requires that the unit efficiency be determined at 100%, 75%, 50% and 25% load (net capacity) at the specified in AHRI Standard.
(d) Outdoor Sound Rating shown is tested in accordance with AHRI Standard 270. For additional information refer to Table 10, p. 9.
(e) For multispeed direct drive rpm TSC/YSC values, reference Table 8, p. 9.
(f) Optional 2” MERV 8 and MERV 13 filters also available.
(g) Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
(h) Heating performance limit settings and rating data were established and approved under laboratory test conditions using American National Standards Institute standards. Ratings shown are for elevations up to 2000 feet. For elevations above 2000 feet, ratings should be reduced at the rate of 4% for each 1000 feet above sea level. Applicable to Gas/Electric units only.
(i) AFUE is rated in accordance with DOE test procedures.

# Evaporator Fan Performance

**Table 2. Direct drive evaporator fan performance - 10 tons standard efficiency - TSC120F3,4,W downflow airflow**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1028 | 0.67 | 1054 | 0.74 | 1079 | 0.81 | 1105 | 0.88 | 1131 | 0.96 | 1157 | 1.04 | 1184 | 1.12 | 1209 | 1.21 | 1234 | 1.30 | 1258 | 1.38 |
| 3600 | 1150 | 0.93 | 1173 | 1.01 | 1196 | 1.09 | 1219 | 1.17 | 1242 | 1.25 | 1265 | 1.34 | 1288 | 1.43 | 1312 | 1.52 | 1335 | 1.61 | 1357 | 1.71 |
| 4000 | 1272 | 1.25 | 1294 | 1.34 | 1315 | 1.43 | 1335 | 1.52 | 1356 | 1.61 | 1376 | 1.70 | 1397 | 1.80 | 1418 | 1.90 | 1440 | 2.00 | 1460 | 2.09 |
| 4400 | 1395 | 1.65 | 1415 | 1.75 | 1435 | 1.84 | 1453 | 1.94 | 1472 | 2.04 | 1490 | 2.14 | 1509 | 2.24 | 1528 | 2.34 | 1547 | 2.45 | 1566 | 2.56 |
| 4800 | 1518 | 2.12 | 1537 | 2.23 | 1555 | 2.33 | 1572 | 2.44 | 1590 | 2.54 | 1606 | 2.65 | 1623 | 2.76 | 1641 | 2.87 | 1657 | 2.98 | 1675 | 3.10 |

**continued**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1280 | 1.46 | 1302 | 1.54 | 1324 | 1.63 | 1347 | 1.71 | 1370 | 1.80 | 1392 | 1.89 | 1414 | 1.99 | 1436 | 2.09 | 1458 | 2.19 | 1479 | 2.28 |
| 3600 | 1379 | 1.80 | 1401 | 1.90 | 1422 | 2.00 | 1441 | 2.09 | 1461 | 2.18 | 1480 | 2.27 | 1501 | 2.36 | 1521 | 2.46 | 1542 | 2.57 | 1561 | 2.67 |
| 4000 | 1481 | 2.20 | 1501 | 2.30 | 1522 | 2.41 | 1542 | 2.52 | 1561 | 2.63 | 1579 | 2.73 | 1597 | 2.84 | 1614 | 2.94 | 1631 | 3.04 | 1649 | 3.14 |
| 4400 | 1585 | 2.67 | 1604 | 2.78 | 1623 | 2.89 | 1642 | 3.01 | 1660 | 3.12 | 1679 | 3.25 | 1696 | 3.36 | — | — | — | — | — | — |
| 4800 | 1693 | 3.22 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**
1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

**Table 3. Direct drive evaporator fan performance - 10 tons standard efficiency - TSC120F3,4,W horizontal airflow**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1016 | 0.65 | 1044 | 0.72 | 1070 | 0.79 | 1097 | 0.87 | 1123 | 0.95 | 1148 | 1.03 | 1173 | 1.10 | 1197 | 1.18 | 1221 | 1.26 | 1245 | 1.34 |
| 3600 | 1137 | 0.91 | 1162 | 0.99 | 1185 | 1.07 | 1209 | 1.15 | 1232 | 1.24 | 1256 | 1.32 | 1279 | 1.41 | 1301 | 1.49 | 1323 | 1.58 | 1344 | 1.66 |
| 4000 | 1258 | 1.22 | 1280 | 1.31 | 1302 | 1.40 | 1323 | 1.49 | 1344 | 1.58 | 1366 | 1.68 | 1387 | 1.78 | 1408 | 1.87 | 1428 | 1.97 | 1448 | 2.06 |
| 4400 | 1379 | 1.60 | 1400 | 1.70 | 1420 | 1.80 | 1439 | 1.90 | 1459 | 2.00 | 1478 | 2.10 | 1497 | 2.21 | 1517 | 2.32 | 1535 | 2.42 | 1554 | 2.52 |
| 4800 | 1501 | 2.06 | 1520 | 2.17 | 1538 | 2.28 | 1557 | 2.38 | 1575 | 2.49 | 1592 | 2.60 | 1609 | 2.71 | 1627 | 2.83 | 1646 | 2.94 | 1663 | 3.06 |

**continued**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1269 | 1.43 | 1293 | 1.52 | 1317 | 1.61 | 1339 | 1.70 | 1361 | 1.78 | 1383 | 1.87 | 1404 | 1.96 | 1425 | 2.05 | 1447 | 2.14 | 1468 | 2.24 |
| 3600 | 1366 | 1.75 | 1386 | 1.84 | 1408 | 1.94 | 1429 | 2.04 | 1451 | 2.15 | 1472 | 2.25 | 1492 | 2.35 | 1513 | 2.45 | 1532 | 2.54 | 1551 | 003 |
| 4000 | 1467 | 2.15 | 1487 | 2.25 | 1506 | 2.34 | 1525 | 2.44 | 1544 | 2.55 | 1563 | 2.65 | 1582 | 2.76 | 1602 | 2.89 | 1620 | 3.00 | 1639 | 3.12 |
| 4400 | 1573 | 2.63 | 1591 | 2.73 | 1609 | 2.84 | 1626 | 2.94 | 1643 | 3.04 | 1661 | 3.15 | 1679 | 3.26 | 1696 | 3.37 | — | — | — | — |
| 4800 | 1681 | 3.18 | 1698 | 3.29 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**
1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

**Table 4. Direct drive evaporator fan performance - 10 tons standard efficiency with gas heat - YSC120F3,4,W*L,M low & medium heat downflow airflow**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1055 | 0.73 | 1081 | 0.81 | 1105 | 0.88 | 1128 | 0.94 | 1152 | 1.01 | 1177 | 1.09 | 1202 | 1.17 | 1225 | 1.25 | 1249 | 1.33 | 1273 | 1.42 |
| 3600 | 1181 | 1.02 | 1204 | 1.10 | 1226 | 1.19 | 1248 | 1.27 | 1268 | 1.34 | 1289 | 1.42 | 1311 | 1.50 | 1333 | 1.59 | 1355 | 1.68 | 1376 | 1.77 |
| 4000 | 1307 | 1.38 | 1328 | 1.47 | 1348 | 1.56 | 1368 | 1.65 | 1388 | 1.74 | 1406 | 1.82 | 1425 | 1.91 | 1444 | 2.00 | 1464 | 2.10 | 1483 | 2.20 |
| 4400 | 1433 | 1.82 | 1453 | 1.92 | 1472 | 2.02 | 1490 | 2.12 | 1508 | 2.22 | 1525 | 2.32 | 1542 | 2.40 | 1559 | 2.49 | 1577 | 2.59 | 1594 | 2.69 |
| 4800 | 1560 | 2.34 | 1578 | 2.45 | 1595 | 2.56 | 1613 | 2.67 | 1629 | 2.77 | 1646 | 2.89 | 1662 | 2.99 | 1677 | 3.09 | 1692 | 3.18 | — | — |

**continued**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1296 | 1.51 | 1319 | 1.61 | 1343 | 1.70 | 1366 | 1.81 | 1390 | 1.91 | 1415 | 2.02 | 1438 | 2.11 | 1461 | 2.21 | 1484 | 2.31 | 1506 | 2.41 |
| 3600 | 1397 | 1.86 | 1418 | 1.95 | 1439 | 2.05 | 1460 | 2.16 | 1480 | 2.27 | 1501 | 2.38 | 1522 | 2.49 | 1543 | 2.61 | 1564 | 2.72 | 1585 | 2.83 |
| 4000 | 1503 | 2.30 | 1522 | 2.39 | 1542 | 2.49 | 1561 | 2.60 | 1579 | 2.70 | 1598 | 2.81 | 1616 | 2.93 | 1635 | 3.05 | 1654 | 3.17 | 1673 | 3.29 |
| 4400 | 1612 | 2.80 | 1630 | 2.91 | 1647 | 3.02 | 1665 | 3.13 | 1683 | 3.24 | 1700 | 3.34 | — | — | — | — | — | — | — | — |
| 4800 | - | - | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**
1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

**Table 5. Direct drive evaporator fan performance - 10 tons standard efficiency with gas heat - YSC120F3,4,W*L,M low & medium heat horizontal airflow**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1043 | 0.70 | 1072 | 0.78 | 1099 | 0.85 | 1128 | 0.94 | 1154 | 1.02 | 1179 | 1.10 | 1203 | 1.17 | 1227 | 1.26 | 1250 | 1.35 | 1274 | 1.44 |
| 3600 | 1166 | 0.98 | 1192 | 1.06 | 1217 | 1.14 | 1241 | 1.23 | 1267 | 1.33 | 1291 | 1.42 | 1314 | 1.51 | 1335 | 1.59 | 1356 | 1.68 | 1378 | 1.78 |
| 4000 | 1290 | 1.32 | 1314 | 1.41 | 1337 | 1.50 | 1359 | 1.60 | 1381 | 1.69 | 1404 | 1.80 | 1426 | 1.91 | 1447 | 2.01 | 1467 | 2.10 | 1486 | 2.20 |
| 4400 | 1415 | 1.73 | 1436 | 1.83 | 1458 | 1.94 | 1478 | 2.04 | 1498 | 2.14 | 1518 | 2.25 | 1539 | 2.37 | 1560 | 2.49 | 1579 | 2.60 | 1597 | 2.70 |
| 4800 | 1540 | 2.23 | 1560 | 2.34 | 1579 | 2.45 | 1598 | 2.56 | 1617 | 2.67 | 1635 | 2.79 | 1653 | 2.90 | 1672 | 3.03 | 1692 | 3.16 | — | — |

**continued**

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1298 | 1.53 | 1323 | 1.63 | 1347 | 1.72 | 1370 | 1.82 | 1394 | 1.92 | 1416 | 2.02 | 1437 | 2.12 | 1459 | 2.22 | 1482 | 2.33 | 1503 | 2.43 |
| 3600 | 1398 | 1.88 | 1419 | 1.98 | 1440 | 2.08 | 1462 | 2.19 | 1484 | 2.30 | 1505 | 2.40 | 1527 | 2.52 | 1547 | 2.62 | 1568 | 2.74 | 1587 | 2.84 |
| 4000 | 1505 | 2.30 | 1524 | 2.41 | 1542 | 2.51 | 1562 | 2.63 | 1581 | 2.74 | 1600 | 2.85 | 1619 | 2.97 | 1639 | 3.09 | 1658 | 3.20 | 1677 | 3.32 |
| 4400 | 1615 | 2.81 | 1633 | 2.91 | 1650 | 3.02 | 1667 | 3.14 | 1685 | 3.26 | 1700 | 3.38 | — | — | — | — | — | — | — | — |
| 4800 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**
1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

## Evaporator Fan Performance

### Table 6. Direct drive evaporator fan performance - 10 tons with standard efficiency gas heat - YSC120F3,4,W*H high heat downflow airflow

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1055 | 0.70 | 1082 | 0.79 | 1109 | 0.87 | 1132 | 0.93 | 1156 | 1.01 | 1180 | 1.09 | 1205 | 1.17 | 1228 | 1.25 | 1252 | 1.33 | 1275 | 1.41 |
| 3600 | 1180 | 0.98 | 1205 | 1.07 | 1229 | 1.16 | 1252 | 1.25 | 1272 | 1.33 | 1293 | 1.40 | 1315 | 1.49 | 1337 | 1.59 | 1358 | 1.68 | 1379 | 1.77 |
| 4000 | 1305 | 1.32 | 1328 | 1.42 | 1350 | 1.52 | 1372 | 1.63 | 1392 | 1.73 | 1410 | 1.80 | 1429 | 1.89 | 1448 | 1.99 | 1468 | 2.09 | 1488 | 2.19 |
| 4400 | 1432 | 1.73 | 1452 | 1.84 | 1473 | 1.96 | 1493 | 2.07 | 1512 | 2.19 | 1530 | 2.29 | 1547 | 2.38 | 1564 | 2.47 | 1581 | 2.57 | 1599 | 2.68 |
| 4800 | 1558 | 2.22 | 1577 | 2.34 | 1596 | 2.47 | 1615 | 2.59 | 1633 | 2.72 | 1650 | 2.84 | 1667 | 2.96 | 1683 | 3.06 | 1698 | 3.15 | — | — |

continued

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1298 | 1.49 | 1322 | 1.59 | 1348 | 1.69 | 1374 | 1.81 | 1398 | 1.91 | 1421 | 2.00 | 1443 | 2.10 | 1465 | 2.20 | 1488 | 2.30 | 1511 | 2.41 |
| 3600 | 1400 | 1.86 | 1421 | 1.95 | 1441 | 2.04 | 1462 | 2.14 | 1483 | 2.24 | 1507 | 2.36 | 1530 | 2.48 | 1552 | 2.61 | 1574 | 2.72 | 1594 | 2.83 |
| 4000 | 1507 | 2.29 | 1526 | 2.39 | 1544 | 2.49 | 1563 | 2.59 | 1582 | 2.69 | 1601 | 2.79 | 1619 | 2.90 | 1639 | 3.01 | 1657 | 3.13 | 1678 | 3.26 |
| 4400 | 1617 | 2.79 | 1635 | 2.91 | 1652 | 3.02 | 1669 | 3.13 | 1687 | 3.23 | — | — | — | — | — | — | — | — | — | — |
| 4800 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**

1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

### Table 7. Direct drive evaporator fan performance - 10 tons standard efficiency with gas heat - YSC120F3,4,W*H high heat horizontal airflow

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .10 | | .20 | | .30 | | .40 | | .50 | | .60 | | .70 | | .80 | | .90 | | 1.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1054 | 0.72 | 1084 | 0.79 | 1112 | 0.86 | 1141 | 0.95 | 1168 | 1.04 | 1193 | 1.12 | 1218 | 1.20 | 1242 | 1.28 | 1266 | 1.38 | 1289 | 1.48 |
| 3600 | 1179 | 1.00 | 1205 | 1.08 | 1231 | 1.16 | 1256 | 1.24 | 1282 | 1.35 | 1306 | 1.45 | 1329 | 1.54 | 1352 | 1.63 | 1374 | 1.72 | 1395 | 1.82 |
| 4000 | 1304 | 1.35 | 1328 | 1.44 | 1352 | 1.53 | 1375 | 1.62 | 1397 | 1.71 | 1420 | 1.83 | 1442 | 1.94 | 1463 | 2.04 | 1484 | 2.14 | 1504 | 2.24 |
| 4400 | 1429 | 1.78 | 1452 | 1.88 | 1474 | 1.98 | 1495 | 2.07 | 1515 | 2.17 | 1536 | 2.27 | 1556 | 2.40 | 1577 | 2.53 | 1597 | 2.64 | 1616 | 2.75 |
| 4800 | 1555 | 2.29 | 1576 | 2.40 | 1596 | 2.51 | 1616 | 2.61 | 1635 | 2.72 | 1654 | 2.82 | 1673 | 2.93 | 1692 | 3.07 | — | — | — | — |

continued

| | External Static Pressure (Inches of Water) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.10 | | 1.20 | | 1.30 | | 1.40 | | 1.50 | | 1.60 | | 1.70 | | 1.80 | | 1.90 | | 2.00 | |
| cfm | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp | rpm | bhp |
| 3200 | 1314 | 1.57 | 1338 | 1.65 | 1362 | 1.74 | 1385 | 1.84 | 1407 | 1.93 | 1430 | 2.02 | 1453 | 2.12 | 1477 | 2.22 | 1498 | 2.32 | 1521 | 2.44 |
| 3600 | 1416 | 1.92 | 1436 | 2.03 | 1458 | 2.14 | 1480 | 2.24 | 1501 | 2.33 | 1522 | 2.43 | 1543 | 2.54 | 1563 | 2.64 | 1583 | 2.74 | 1604 | 2.85 |
| 4000 | 1524 | 2.35 | 1543 | 2.46 | 1562 | 2.56 | 1581 | 2.68 | 1600 | 2.80 | 1619 | 2.93 | 1638 | 3.04 | 1658 | 3.15 | 1677 | 3.26 | 1695 | 3.37 |
| 4400 | 1635 | 2.87 | 1653 | 2.97 | 1671 | 3.09 | 1689 | 3.21 | — | — | — | — | — | — | — | — | — | — | — | — |
| 4800 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

**Notes:**

1. For Direct Drive Evaporator Fan Speed (rpm), reference Table 8, p. 9.
2. Data includes pressure drop due to standard filters and wet coils.
3. Refer to Table 11, p. 9 to determine additional static pressure drop due to other options/accessories.
4. Direct Drive Fan Motor Heat (MBH) = 2.8623xFan BHP -0.1504
5. Factory supplied motors, in commercial equipment, are definite purpose motors, specifically designed and tested to operate reliably and continuously at all cataloged conditions. Using the full horsepower range of our fan motors as shown in our tabular data will not result in nuisance tripping or premature motor failure. Our product's warranty will not be affected.

# Performance Data

### Table 8. RPM table

| T/YSC120F | | | | |
|---|---|---|---|---|
| Potentiometer Voltage | Motor RPM | | Potentiometer Voltage | Motor RPM |
| 1.25 | 217 | | 4.50 | 1061 |
| 1.50 | 312 | | 4.75 | 1126 |
| 1.75 | 362 | | 5.00 | 1191 |
| 2.00 | 427 | | 5.25 | 1253 |
| 2.25 | 479 | | 5.50 | 1315 |
| 2.50 | 543 | | 5.75 | 1374 |
| 2.75 | 605 | | 6.00 | 1432 |
| 3.00 | 668 | | 6.25 | 1487 |
| 3.25 | 732 | | 6.50 | 1539 |
| 3.50 | 797 | | 6.75 | 1588 |
| 3.75 | 863 | | 7.00 | 1633 |
| 4.00 | 929 | | 7.25 | 1675 |
| 4.25 | 995 | | 7.50 | 1700 |

**Note:** Factory setting is 5V

### Table 9. 10 tons air temperature rise across electric heaters (°F)

| kW | Stages | 10 Tons 4000 cfm[(a)] TSC120F3,4,W |
|---|---|---|
| 18.0 | 1 | 14.2 |
| 27.0 | 2 | 21.3 |
| 36.0 | 2 | 28.5 |
| 54.0 | 2 | 42.7 |

**Notes:**

1. For minimum design airflow, see airflow performance table for each unit.
2. To calculate temp rise at different airflow, use the following formula: Temp. rise across Electric Heater = kWx3414/ 1.08xCFM.

(a) Minimum allowable airflow with a 54 kW heater is 3400 CFM

### Table 10. Outdoor sound power level - dB (ref. 10 - 12 W)

| Tons | Unit Model Number | Octave Center Frequency 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Overall dBA |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | T/YSC120F | 91 | 86 | 90 | 86 | 82 | 78 | 73 | 67 | 88 |

**Note:** Tests follow AHRI270-95.

### Table 11. Static pressure drop through accessories (inches water column) - 10 tons

| | | | | | | Economizer with OA/RA Dampers[(a)] | | | | | | Electric Heater Accessory (kW)[(b)],[(c)] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tons | Unit Model Number | cfm | Standard Filters[(d)] | 2" MERV 8 Filter | 2" MERV 13 Filter | 100% OA Downflow | 100% RA Downflow | 100% OA Low Leak[(e)] | 100% RA Low Leak[(e)] | 100% OA Horizontal | 100% RA Horizontal | 5-6 | 9-18 | 23-36 | 54 |
| 10 | T/YSC120F | 3200 | 0.07 | 0.10 | 0.14 | 0.17 | 0.05 | 0.42 | 0.18 | 0.14 | 0.05 | — | 0.02 | 0.03 | 0.05 |
| 10 | T/YSC120F | 4000 | 0.11 | 0.15 | 0.16 | 0.26 | 0.07 | 0.63 | 0.21 | 0.30 | 0.08 | — | 0.02 | 0.03 | 0.05 |
| 10 | T/YSC120F | 4800 | 0.16 | 0.20 | 0.18 | 0.34 | 0.09 | 0.91 | 0.34 | 0.35 | 0.10 | — | 0.03 | 0.04 | 0.06 |

(a) OA = Outside Air and RA = Return Air.
(b) Nominal kW ratings at 240, 480, 600 volts. Heaters only available on T units.
(c) Electric heaters restricted on applications below 320 cfm/Ton.
(d) Tested with standard filters. Difference in pressure drop should be considered when utilizing optional 2" MERV 8 and MERV 13 filters.
(e) Low Leak - Downflow only.

# Electrical Data

### Table 12. Unit wiring - standard efficiency

| | | | Standard Indoor Fan Motor[a] | |
|---|---|---|---|---|
| Tons | Unit Model Number | Voltage Range | MCA | Max Fuse Size or Max Circuit Breaker |
| 10 | T/YSC120F3 | 187-253 | 49.6 | 60 |
| 10 | T/YSC120F4 | 414-506 | 22.7 | 30 |
| 10 | T/YSC120FW | 517-633 | 18.9 | 25 |

(a) The standard motor for the 3-phase models is a Belt Drive Motor.

### Table 13. Unit wiring with electric heat (single point connection) - standard efficiency

| | | | | | Standard Indoor Motor | |
|---|---|---|---|---|---|---|
| Tons | Unit Model Number | Heater Model Number | Heater kW Rating[a] | Control Stages | MCA | Max Fuse Size or Max Circuit Breaker |
| 208/230 Volts Three Phase | | | | | | |
| 10 | TSC120F3 | BAYHTRA318* | 13.5/18.0 | 1 | 57.5/64.8 | 60/70 |
| 10 | TSC120F3 | BAYHTRA327* | 20.3/27.0 | 2 | 81.0/91.9 | 90/100 |
| 10 | TSC120F3 | BAYHTRA336* | 27.0/36.0 | 2 | 104.5/118.9 | 110/125 |
| 10 | TSC120F3 | BAYHTRA354* | 40.6/54.0 | 2 | 151.4/140.5 | 175/150 |
| 480 Volts Three Phase | | | | | | |
| 10 | TSC120F4 | BAYHTRA418* | 18.0 | 1 | 32.5 | 35 |
| 10 | TSC120F4 | BAYHTRA427* | 27.0 | 2 | 46.0 | 50 |
| 10 | TSC120F4 | BAYHTRA436* | 36.0 | 2 | 59.5 | 60 |
| 10 | TSC120F4 | BAYHTRA454* | 54.0 | 2 | 70.4 | 80 |
| 575 Volts Three Phase | | | | | | |
| 10 | TSC120FW | BAYHTRAW18* | 18.0 | 1 | 27.0 | 30 |
| 10 | TSC120FW | BAYHTRAW36* | 36.0 | 2 | 48.6 | 50 |
| 10 | TSC120FW | BAYHTRAW54* | 54.0 | 2 | 57.4 | 60 |

(a) Heater kwratings are at 208/240V for 208/230V units, 480V for 460V units and 600V for 575V units.

### Table 14. Electrical characteristics - compressor motor and condenser motor - 60 cycle - standard efficiency

| | | Compressor Motors | | | | | | | Condenser Fan Motors | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Amps[a] | | | | | | Amps[a] | |
| Tons | Unit Model Number | No. | Volts | Phase | hp[b] | rpm | RLA | LRA | No. | Volts | Phase | hp | FLA | LRA |
| 10 | T/YSC120F3 | 2 | 208-230 | 3 | 4.9/3.8 | 3500/3500 | 19.6/13.1 | 136.0/83.0 | 1 | 208-230 | 1 | 0.75 | 3.5 | 9.3 |
| 10 | T/YSC120F4 | 2 | 460 | 3 | 4.9/3.8 | 3500/3500 | 8.2/6.1 | 66.0/41.0 | 1 | 460 | 1 | 0.75 | 2.0 | 6.2 |
| 10 | T/YSC120FW | 2 | 575 | 3 | 4.9/3.8 | 3500/3500 | 6.7/4.4 | 54.0/33.0 | 1 | 575 | 1 | 0.75 | 1.8 | 5.4 |

(a) Amp draw for each motor; multiply value by number of motors to determine total amps.
(b) hp for each compressor.

**Table 15. Electrical characteristics - standard evaporator fan motor - 60 cycle - direct or belt drive standard efficiency**

| Tons | Unit Model Number | Direct or Belt Drive | No. | Volts | Phase | hp | Amps FLA | Amps LRA |
|---|---|---|---|---|---|---|---|---|
| 10 | T/YSC120F3 | Direct Drive | 1 | 208-230 | 3 | 3.80 | 8.50-8.50 | — |
| 10 | T/YSC120F4 | Direct Drive | 1 | 460 | 3 | 3.60 | 4.30 | — |
| 10 | T/YSC120FW[a] | Direct Drive | 1 | 460 | 3 | 3.60 | 4.30 | — |

(a) T/YSC120FW utilize 460V Evaporator Motors.

**Table 16. Electrical characteristics — power exhaust (cooling and gas/electric)**

| Tons | Volts | Phase | hp | rpm | FLA | LRA |
|---|---|---|---|---|---|---|
| 10 | 208-230 | 1 | 0.87 | 1075[a] | 5.7 | 16.3 |
| 10 | 460 | 1 | 0.87 | 1075(a) | 3.3 | 6.8 |
| 10 | 575 | 1 | 0.87 | 1075(a) | 2.3 | 5.4 |

(a) Two speed.

**Table 17. Electrical characteristics - inducer motor**

| Unit Model Number | Stages | hp | rpm | Volts | Phase | LRA |
|---|---|---|---|---|---|---|
| YSC120F | 2 | 1/15 | 3350 | 208-230 | 1 | 0.4 |

# Sequence of Operation

These units are offered with two control options, electromechanical and ReliaTel™.

***Note:*** *Refer to the unit nameplate: If the 9th digit of the model number = R, proceed with the following Sequence of Operation. If the 9th digit of the model number = E, proceed with* *"Electromechanical Controls," p. 16**.*

***Note:*** *The Condensate Overflow Switch (COF) (optional) will shut the unit down if the float is raised and the switch is closed.*

## ReliaTel Controls

ReliaTel Control is a microelectronic control feature, which provides operating functions that are significantly different than conventional electromechanical units. The master module is the ReliaTel Refrigeration Module (RTRM).

The RTRM provides compressor anti-short cycle timing functions through minimum "Off" and "On" timing to increase reliability, performance and to maximize unit efficiency.

Upon power initialization, the RTRM performs self-diagnostic checks to insure that all internal controls are functioning. It checks the configuration parameters against the components connected to the system.

The LED located on the RTRM module is turned "On" within one second after power-up if all internal operations are okay.

### ReliaTel Control Cooling without an Economizer

When the system switch is set to the "Cool" position and the zone temperature rises above the cooling setpoint control band, the RTRM energizes the (K9) relay coil located on the RTRM. When the K9 relay contacts close, the compressor contactor (CC1) coil is energized provided the low pressure control (LPC1), high pressure control (HPC1) and discharge line thermostat (TDL 1) are closed. When the CC1 contacts close, compressor (CPR1) and the outdoor fan motor (ODM) start to maintain the zone temperature to within ± 2°F of the sensor setpoint at the sensed location.

If the first stage of cooling can not satisfy the cooling requirement, the RTRM energizes the (K10) relay coil located on the RTRM. When the (K10) relay contacts close, the compressor contactor (CC2) coil is energized provided the low pressure control (LPC2), high pressure control (HPC2) and discharge line thermostat (TDL 2) are closed. When the CC2 contacts close, compressor (CPR2) starts to maintain the zone temperature to within ± 2°F of the sensor setpoint at the sensed location.

### Three-Stages of Cooling[1]

When the unit is configured for three-stage cooling, and the system switch is set to the cool position and the zone temperature rises above the cooling setpoint control band, the RTRM energizes the (K10) relay coil located on the RTRM. When the (K10) relay contacts close, compressor contactor (CC2) is energized. This is the smaller of the two compressors (CPR2). This staging order is opposite standard staging order.

If the first stage of cooling can not satisfy the cooling requirement, the RTRM energizes the (K9) relay coil and de-energizes the (K10) relay coil on the RTRM. Compressor contactor (CC1) is energized, bringing on the larger of the two compressors (CPR1). Compressor contactor (CC2) is de-energized, turning off the smaller compressor.

If the second stage of cooling can not satisfy the cooling requirement, the RTRM keeps the (K9) relay coil energized and energizes the (K10) relay coil. Compressor contactors (CC1) and (CC2) are energized, and both compressors (CPR1 and CPR2).

Lead/Lag is disabled with three-stage cooling. A unit configured for three-stage cooling and controlled with a thermostat will operate as a two-stage unit.

### ReliaTel Control Evaporator Fan Operation (for Gas Units)

When the fan selection switch is set to the "Auto" position, the RTRM energizes the (K6) relay coil approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the RTRM energizes the (K6) relay coil approximately 45 second after gas ignition. Closing the (K6) contacts on the RTRM energizes the indoor fan relay (F) coil to start the indoor fan motor (IDM).

The RTRM de-energizes the fan relay (F) approximately 60 seconds after the cooling requirement has be satisfied to enhance unit efficiency. When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized approximately 90 seconds after the heating requirement.

When the fan selection switch is set to the "On" position, the RTRM keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

When the unit is equipped with the optional clogged filter switch, wired between terminals J7-3 and J7-4 on the ReliaTel Options Module (RTOM), the RTRM produces an analog output if the clogged filter switch (CFS) closes for two minutes after a request for fan operation. When the system is connected to a remote panel, the "SERVICE" LED will be turned on when this failure occurs.

[1] High efficiency units only.

## ReliaTel Control Evaporator Fan Operation (for Cooling Only Units)

When the fan selection switch is set to the “Auto” position, the RTRM energizes the (K6) relay coil approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the RTRM energizes the (K6) relay coil approximately 1 second before energizing the electric heat contactors. Closing the (K6) contacts on the RTRM energizes the indoor fan relay (F) coil to start the indoor fan motor (IDM). The RTRM de-energizes the fan relay (F) approximately 60 seconds after the cooling requirement has be satisfied to enhance unit efficiency.

When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized at the same time as the heater contactors.

When the fan selection switch is set to the “On” position, the RTRM keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

When the unit is equipped with the optional clogged filter switch, wired between terminals J7-3and J7-4 on the ReliaTel Options Module (RTOM), the RTRM produces an analog output if the clogged filter switch (CFS) closes for two minutes after a request for fan operation.

When the system is connected to a remote panel, the “SERVICE” LED will be turned on when this failure occurs.

## Low Ambient Operation

During low ambient operation, outside air temperature below 55°F, the RTRM will cycle the compressor and outdoor fan motor “Off” for approximately 3 minutes after every 10 minutes of accumulated compressor run time. The indoor fan motor (IDM) will continue to operate during this evaporator defrost cycle (EDC) and the compressor and outdoor fan will return to normal operation once the defrost cycle has terminated and the compressor “Off” time delay has been satisfied.

***Note:*** *(For units with the dehumidification option) When in dehumidification mode, the unit will not cycle as described above. The unit will run continuously in dehumidification mode at all ambient conditions above 40°F. Dehumidification is disabled at ambient conditions below 40°F.*

## ReliaTel Control Dehumidification

### Single Compressor Units

On a call for dehumidification, the reheat valve is energized and the compressor is turned on. When the humidity control setpoint is satisfied, the valve is de-energized and the compressor is turned off. If there is a call for cooling or heating from the space temperature controller, i.e. zone sensor or thermostat, while in reheat, the reheat valve is de-energized and the compressor continues to run, or the heat is turned on. The 3 minute compressor on and off times are still active during compressor operation.

### Dual Compressor Units

The dehumidification cycle is only permitted above 40°F as indicated above and is not permitted during a heating cycle or during a demand for 2nd stage cooling. Otherwise, when an installed zone humidity sensor indicates a relative humidity equal to or greater than the RH set point as adjusted on the ReliaTel Options Module (RTOM), a dehumidification cycle is initiated. The Sequence of Operation for the dehumidification cycle is identical to that of the second stage ReliaTel cooling cycle, except that the hot gas reheat valve (RHV) is energized, allowing air from the evaporator to be reheated. Also, any installed fresh air damper is driven to minimum position.The dehumidification cycle is terminated by initiation of a heating cycle or a 2nd stage cooling cycle or when zone humidity is reduced to 5% below the R.H. set point. In the absence of a zone humidity sensor input, an on/off input from a zone humidistat is used to initiate/terminate the dehumidification cycle.

Dehumidification takes priority over a call for one-stage cooling.

Heating or two-stage cooling takes priority over dehumidification, and a relative humidity sensor takes priority over a humidistat.

## Dehumidification Coil Purge Cycle

On multiple circuit units with dehumidification/reheat configured, a purge cycle will be active for compressor reliability. The purpose of this function is to properly distribute refrigerant and lubricant throughout the system by temporarily switching to the unused section of the coil for 3 minutes (purge cycle). The function operates as follows:

1. A purge cycle will be initiated after 90 minutes of accumulated compressor run time in only one mode: cooling or dehumidification, without transitioning to the other mode.
2. A purge cycle will consist of transitioning to the mode that hasn’t run in 90 minutes of total compressor operation. The cycle will last for a period of 3 minutes.
3. The 90-minute cycle count will be reset anytime there is a normal transition between cooling and dehumidification. Transitioning from one of these modes to any other mode (off or heat) will not reset the counter.
4. If the purge cycle is a cooling cycle, only the first circuit will be activated. If it is a dehumidification cycle then the normal 2-compressor dehumidification mode cycle will be used.
5. The purge cycle will ignore the low ambient dehumidification lockout feature.

6. A purge cycle takes priority over normal cooling or dehumidification requests, but will discontinue for all high priority lockouts and alarms.

## ReliaTel Control Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. Outside air is drawn into the unit through modulating dampers. When cooling is required and economizing is possible, the RTRM sends the cooling request to the unit economizer actuator (ECA) to open the economizer damper. The RTRM tries to cool the zone utilizing the economizer to slightly below the zone temperature setpoint. If the mixed air sensor (MAS) senses that the mixed air temperature is below 53°F, the damper modulates toward the closed position. If the zone temperature continues to rise above the zone temperature setpoint control band and the economizer damper is full open for 5 minutes, the RTRM energizes the compressor contactor (CC1). If the zone temperature continues to rise above the zone temperature setpoint control band and the economizer damper is fully open, the RTRM energizes the compressor contactor (CC2).

The ECA continues to modulate the economizer damper open/closed to keep the mixed air temperature that is calculated by the RTRM.

If economizing is not possible, the ECA drives the damper to the minimum position setpoint when the indoor fan relay (F) is energized and allows mechanical cooling operation.

When the unit is equipped with the optional fan failure switch, wired between terminals J7-5 and J7-6 on the RTOM, the RTRM will stop all cooling functions and produce an analog output if the fan failure switch (FFS) does not open within 40 seconds after a request for fan operation. When the system is connected to a remote panel, the “SERVICE” LED will flash when this failure occurs.

***Note:*** *For units equipped with the dehumidification option, if the unit is economizing, the damper resets to minimum position while in dehumidification mode.*

## Economizer Set-Up

Adjusting the minimum position potentiometer located on the unit economizer actuator (ECA) sets the required amount of ventilation air.

Two of the three methods for determining the suitability of the outside air can be selected utilizing the enthalpy potentiometer on the ECA, as described below:

1. Ambient Temperature - controlling the economizing cycle by sensing the outside air dry bulb temperature. Table 18, p. 14 lists the selectable dry bulb values by potentiometer setting.
2. Reference Enthalpy - controlling the economizer cycle by sensing the outdoor air humidity. Table 18, p. 14 lists the selectable enthalpy values by potentiometer setting. If the outside air enthalpy value is less than the selected value, the economizer is allowed to operate.
3. Comparative Enthalpy - utilizing a humidity sensor and a temperature sensor in both the return air stream and the outdoor air stream, the unit control processor (RTRM) will be able to establish which conditions are best suited for maintaining the zone temperature, i.e. indoor conditions or outdoor conditions. The potentiometer located on the ECA is non-functional when both the temperature and humidity sensors are installed.

**Table 18. Potentiometer settings**

| Potentiometer Setting | Dry Bulb | Reference Enthalpy |
|---|---|---|
| A | 73°F (22.8°C) | 27 Btu/lb (63 kJ/kg) |
| B | 70°F (21.1°C) | 25 Btu/lb (58 kJ/kg) |
| C | 67°F[(a)] (19.4°C) | 23 Btu/lb (53 kJ/kg) |
| D | 63°F (17.2°C) | 22 Btu/lb (51 kJ/kg) |
| E | 55°F (12.8°C) | 19 Btu/lb (44 kJ/kg) |

(a) Factory settings

## ReliaTel Control Heating Operation (for Cooling Only Units)

When the system switch is set to the “Heat” position and the zone temperature falls below the heating setpoint control band, the RTRM energizes (K1) relay coil. When the (K1) relay contacts close, located on the RTRM, the first stage electric heat contactor (AH or AH & CH) is energized.

If the first stage of electric heat can not satisfy the heating requirement, the RTRM energizes (K2) relay coil. When the (K2) relay contacts close, located on the RTRM, the second stage electric heat contactor (BH) is energized, if applicable. The RTRM cycles both the first and second stages of heat “On” and “Off” as required to maintain the zone temperature setpoint.

## ReliaTel Control Heating Operation (for Gas Units)

When the system switch is set to the “Heat” position and the zone temperature falls below the heating setpoint control band, a heat cycle is initiated when the RTRM communicates ignition information to the Ignition module (IGN).

## Ignition Module

Two-stage (IGN) runs self-check (including verification that the gas valve is de-energized). (IGN) checks the high-limit switches (TC01 & TC02) for normally closed contacts, the pressure switch (PS) for normally open contacts, and the flame rollout (FR) switch for continuity. (IGN) energizes inducer blower on high speed to check pressure switch closure. If the pressure switch is closed, the inducer blower starts a 20-second pre-purge (15 seconds on high speed followed by 5 seconds on low speed). If the pressure switch (PS) is still open, the inducer blower will continue to be energized on high speed until pressure switch closure. After pre-purge completes, the (IGN) energizes the first stage of the gas valve, initiates spark for 2 seconds minimum, 7 seconds maximum (ignition trial) and detects flame and de-energizes spark. From this point, a fixed 45 second indoor blower delay on timing starts. After the indoor blower delay on is completed, the (IGN) energizes the indoor blower. The (IGN) enters a normal operating loop where all inputs are continuously monitored. If the first stage of gas heat can not satisfy the heating requirement, the thermostat closes W2. The (IGN) energizes the second stage of the gas valve and the second stage of inducer blower. When the zone thermostat is satisfied, the (IGN) de-energizes the gas valve. The (IGN) senses loss of flame. The (IGN) initiates a 5 second inducer blower post purge. The (RTRM) initiates a second indoor blower delay off.

If the burner fails to ignite, the ignition module will attempt two retries before locking out. The green LED will indicate a lock out by two fast flashes. An ignition lockout can be reset by;

1. Opening for 3 seconds and closing the main power disconnect switch.
2. Switching the “Mode” switch on the zone sensor to “OFF” and then to the desired position.
3. Allowing the ignition control module to reset automatically after one hour. Refer to the “Ignition Control Module Diagnostics” section for the LED diagnostic definitions.

When the fan selection switch is set to the “Auto” position, the RTRM energizes the indoor fan relay (F) coil approximately 30 second after initiating the heating cycle to start the indoor fan motor (IDM).

**Table 19. Ignition module diagnostics**

| | |
|---|---|
| **Steady light** | Module is powered up, but no active call for heat. |
| **Blinking at continuous steady rate** | Active call for heat. |
| **One blink** | Loss of communication. |
| **Two blinks** | System lockout (failure to ignite, no spark, low/no gas pressure, etc.) |
| **Three blinks** | Pressure switch (no vent air flow, bad CBM, closed at initial call for heat). Auto reset. |
| **Four blinks** | High limit (excessive heat in combustion chamber, low airflow). Auto reset. |
| **Five blinks** | Flame sensed and gas valve not energized or flame sensed and no call for heat. |
| **Six blinks** | Flame rollout (CBM failure, incorrect gas pressure, incorrect primary air). Requires manual reset of the switch. |
| **Seven blinks** | ReliaTel module will communicate a heat fail diagnostic back to the RTRM. |

## Drain Pan Condensate Overflow Switch (Optional)

This input incorporates the Condensate Overflow Switch (COF) mounted on the drain pan and the ReliaTel Options Module (RTOM). When the condensate level reaches the trip point for 6 continuous seconds, the RTOM will shut down all unit function until the overflow condition has cleared. The unit will return to normal operation after 6 continuous seconds with the COF in a non-tripped condition. If the condensate level causes the unit to shutdown more than 2 times in a 3 day period, the unit will be locked-out of operation. A manual reset of the diagnostic system through the zone sensor or Building Automation System (BAS) will be required. Cycling unit power will also clear the fault.

# VAV Units Only-Sequence of Operation

## Supply Air Pressure Control

### ReliaTel Option Module Control (RTOM)

Supply fan is driven by a pulse-width modulation (PWM) signal from the RTOM. A pressure transducer measures duct static pressure, and the supply fan is modulated to maintain the supply air static pressure within an adjustable user-defined range. The range is determined by the supply air pressure setpoint and supply air pressure deadband, which are set through a unit mounted potentiometer. The RTOM provides supply fan motor speed modulation.

The supply fan will accelerate or decelerate as required to maintain the supply static pressure setpoint.

## Supply Air Static Pressure Limit

The control of the supply fan and VAV boxes are coordinated, with respect to time, during unit start up and transition to/from Occupied/Unoccupied modes to prevent overpressurization of the supply air ductwork. However, if for any reason the supply air pressure exceeds the fixed supply air static pressure limit of 3.5" W.C., the supply fan is shut down and the VAV boxes are closed. The unit is then allowed to restart three times. If the overpressurization condition occurs on the fourth time, the unit is shut down and a manual reset diagnostic is set and displayed at any of the remote panels with LED status lights or communicated to the Integrated Comfort system.

## Supply Air Temperature Controls

### Cooling/Economizer

During occupied cooling mode of operation, the economizer (if available) and primary cooling are used to control the supply air temperature. The supply air temperature setpoint is user-defined at the unit mounted VAV Setpoint Potentiometer or at the remote panel. If the enthalpy of the outside air is appropriate to use "free cooling," the economizer will be used first to attempt to satisfy the supply setpoint. On units with economizer, a call for cooling will modulate the fresh air dampers open. The rate of economizer modulation is based on deviation of the discharge temperature from setpoint, i.e., the further away from setpoint, the faster the fresh air damper will open. Note that the economizer is only allowed to function freely if ambient conditions are below the enthalpy control setting or below the return air enthalpy if unit has comparative enthalpy installed. If outside air is not suitable for "economizing," the fresh air dampers drive to the minimum open position. A field adjustable potentiometer on the Economizer Actuator, or a remote potentiometer can provide the input to establish the minimum damper position. At outdoor air conditions above the enthalpy control setting, primary cooling only is used and the fresh air dampers remain at minimum position. If the unit does not include an economizer, primary cooling only is used to satisfy cooling requirements.

## Supply Air Setpoint Reset

Supply air reset can be used to adjust the supply air temperature setpoint on the basis of a zone temperature, return air temperature, or on outdoor air temperature. Supply air reset adjustment is available on the unit mounted VAV Setpoint Potentiometer for supply air cooling control.

**Reset Based on Outdoor Air Temperature.** Outdoor air cooling reset is sometimes used in applications where the outdoor temperature has a large effect on building load. When the outside air temperature is low and the building cooling load is low, the supply air setpoint can be raised, thereby preventing subcooling of critical zones. This reset can lower usage of primary cooling and result in a reduction in primary cooling energy usageThere are two user-defined parameters that are adjustable through the VAV Setpoint Potentiometer: reset temperature setpoint and reset amount. The amount of reset applied is dependent upon how far the outdoor air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount input. The maximum value is 20°F. If the outdoor air temperature is more than 20°F below the reset temperature setpoint the amount of reset is equal to the reset amount setpoint.

**Reset Based on Zone or Return Temperature.** Zone or return reset is applied to the zone(s) in a building that tend to overcool or overheat. The supply air temperature setpoint is adjusted based on the temperature of the critical zone(s) or the return air temperature. This can have the effect of improving comfort and/or lowering energy usage. The user-defined parameters are the same as for outdoor air reset. Logic for zone or return reset control is the same except that the origins of the temperature inputs are the zone sensor or return sensor respectively. The amount of reset applied is dependent upon how far the zone or return air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount potentiometer on the VAV Setpoint Potentiometer. The maximum value is 3°F. If the return or zone temperature is more than 3°F below the reset temperature setpoint the amount of reset is equal to the reset amount setpoint.

## Zone Temperature Control

### Unoccupied Zone Cooling

During Unoccupied mode, the unit is operated as a CV unit. VAV boxes are driven full open and the supply fan is commanded to full speed. The unit controls zone temperature to the Unoccupied zone cooling setpoints.

### Daytime Warm-up

During occupied mode, if the zone temperature falls to a temperature three degrees below the Morning Warm-up setpoint, Daytime Warm-up is initiated. The system changes to CV heating (full unit airflow), the VAV boxes are fully opened and the CV heating algorithm is in control until the Morning Warm-up setpoint is reached. The unit is then returned to VAV cooling mode. The Morning Warm-up setpoint is set at the unit mounted VAV Setpoint potentiometer or at a remote panel.

### Morning Warm-up (MWU)

Morning warm-up control (MWU) is activated whenever the unit switches from unoccupied to occupied and the zone temperature is at least 1.5°F below the MWU setpoint. When MWU is activated the VAV box output will be energized for at least 6 minutes to drive all boxes open, the supply fan is commanded to full speed, and full heat (gas or electric) is energized. When MWU is activated the economizer damper is driven fully closed. When the zone temperature meets or exceeds the MWU setpoint minus 1.5°F, the heat will be turned or staged down. When the zone temperature meets or exceeds the MWU setpoint then MWU will be terminated and the unit will switch over to VAV cooling.

# Electromechanical Controls

These units are offered with two control options, electromechanical and ReliaTel controls. The ReliaTel controls is a microelectronic control feature, which provides operating functions that are significantly different than conventional electromechanical units.

## Electromechanical Control Cooling without an Economizer

When the thermostat switch is set to the “Cool” position and the zone temperature rises above the cooling setpoint, the thermostat Y contacts close. The compressor contactor (CC1) coil is energized provided the low pressure control (LPC1), high pressure control (HPC1) and discharge line thermostat (TDL 1) are closed. When the (CC1) contacts close, compressor (CPR1) and the outdoor fan motor (ODM) start. If the first stage of cooling can not satisfy the cooling requirement, the thermostat closes Y2. The compressor contactor (CC2) coil is energized provided the low pressure control (LPC2), high pressure control (HPC2) and discharge line thermostat (TDL 2) are closed.

When the (CC2) contacts close, compressor (CPR2) starts.

## Electromechanical Control Evaporator Fan Operation (for Gas Units)

When the thermostat fan selection switch is set to the “Auto” position, the Ignition Module (IGN) energizes the indoor fan relay (F) approximately 1 second after energizing the compressor contactor coil (CC1) in the cooling mode. In the heating mode, the Ignition Module (IGN) energizes the indoor fan relay (F) coil approximately 45 second after gas ignition. Closing indoor fan relay (F) coil starts the indoor fan motor (IDM). The (IGN) de-energizes the fan relay (F) approximately 80 seconds after the cooling requirement has been satisfied to enhance unit efficiency.

When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized approximately 90 seconds after the heating requirement.

When the thermostat fan selection switch is set to the “On” position, the (IGN) keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

## Electromechanical Evaporator Fan Operation (for Cooling Only Units)

When the thermostat fan selection switch is set to the “Auto” position, the thermostat energizes the indoor fan relay coil (F) to start the indoor fan motor (IDM). The fan relay (F) de-energizes after the cooling requirement has been satisfied. When the heating cycle is terminated, the indoor fan relay (F) coil is de-energized with heater contactors.

When the thermostat fan selection switch is set to the “On” position, the thermostat keeps the indoor fan relay coil (F) energized for continuous fan motor operation.

## Economizer Set-Up

Adjusting the minimum position potentiometer located on the unit economizer actuator (ECA) sets the required amount of ventilation air.

Ambient temperature is controlling the economizing cycle by sensing the outside air dry bulb temperature. Table 18, p. 14 lists the selectable dry bulb values by potentiometer setting.

## Electromechanical Control Cooling with an Economizer

The economizer is utilized to control the zone temperature providing the outside air conditions are suitable. Outside air is drawn into the unit through modulating dampers.

When cooling is required and economizing is possible, the unit economizer actuator (ECA) opens the economizer damper. The ECA continues to modulate the economizer damper open/closed to keep the mixed air temperature in the 50°F to 55°F range.

The thermostat will close the Y2 contacts to turn on contactor (CC1) if mechanical cooling is required.

If economizing is not possible, the ECA drives the damper to the minimum position setpoint when the indoor fan relay (F) is energized and allows mechanical cooling operation.

## Electromechanical Control Heating Operation (for Cooling Only Units)

When the system switch is set to the “Heat” position and the zone temperature falls below the heating setpoint, the thermostat closes W1 contacts the first stage electric heat contactor (AH or AH & CH) is energized. If the first stage of electric heat can not satisfy the heating requirement, the thermostat closes W2.

When the W2 contacts close, the second stage electric heat contactor (BH) is energized, if applicable. The thermostat cycles both the first and second stages of heat “On” and “Off” as required to maintain the zone temperature setpoint.

## Electromechanical Control Heating Operation (for Gas Units)

When the system switch is set to the “Heat” position and the zone temperature falls below the heating setpoint, the Ignition module (IGN) initiates a heat cycle.

## Ignition Module Low, Medium and High Heat

Two-stage (IGN) runs self-check (including verification that the gas valve is de-energized). (IGN) checks the high-limit switches (TC01 & TC02) for normally closed contacts, the pressure switch (PS) for normally open contacts, and the flame rollout (FR) switch for continuity. (IGN) energizes inducer blower on high speed to check pressure switch closure.

If the pressure switch is closed, the inducer blower starts a 20 second pre-purge (15 seconds on high speed followed by 5 seconds on low speed).

If the pressure switch (PS) is still open, the inducer blower will continue to be energized on high speed until pressure switch closure.

After pre-purge completes, the (IGN) energizes the first stage of the gas valve, initiates spark for 2 seconds minimum, 7 seconds maximum (ignition trial) and detects flame and de-energizes spark. From this point, a fixed 45 second indoor blower delay on timing starts.

After the indoor blower delay on is completed, the (IGN) energizes the indoor blower. The (IGN) enters a normal operating loop where all inputs are continuously monitored. If the first stage of gas heat can not satisfy the heating requirement, the thermostat closes W2. The (IGN) energizes the second stage of the gas valve and the second stage of inducer blower.

When the zone thermostat is satisfied, the (IGN) de-energizes the gas valve. The (IGN) senses loss of flame. The (IGN) initiates a 5 second inducer blower post purge and 90 second indoor blower delay off at current speed. The (IGN) de-energizes the inducer blower at the end of the post purge. The (IGN) de-energizes the indoor blower at the end of the selected indoor blower delay off.

**Table 20. Ignition module diagnostics**

| | |
|---|---|
| **Steady light** | Module is powered up, but no active call for heat. |
| **Blinking at continuous steady rate** | Active call for heat. |
| **One blink** | Loss of communication. |
| **Two blinks** | System lockout (failure to ignite, no spark, low/no gas pressure, etc.) |
| **Three blinks** | Pressure switch (no vent air flow, bad CBM, closed at initial call for heat). Auto reset. |
| **Four blinks** | High limit (excessive heat in combustion chamber, low airflow). Auto reset. |
| **Five blinks** | Flame sensed and gas valve not energized or flame sensed and no call for heat. |
| **Six blinks** | Flame rollout (CBM failure, incorrect gas pressure, incorrect primary air). Requires manual reset of the switch. |
| **Seven blinks** | W1& W2 swapped (electromechanical 3-10 tons units). |

## Drain Pan Condensate Overflow Switch (Optional)

The Condensate Overflow Switch (COF) is utilized to prevent water overflow from the drain pan. The float switch is installed on the corner lip of the drain pan. When the condensate level reaches the trip point, the COF relay energizes and opens the 24VAC control circuit which disables the unit. Once the 24VAC control circuit is opened, a delay timer will prevent unit start-up for three minutes.

# Pressure Curves

**Figure 1. T/YSC120F pressure curve system 1**

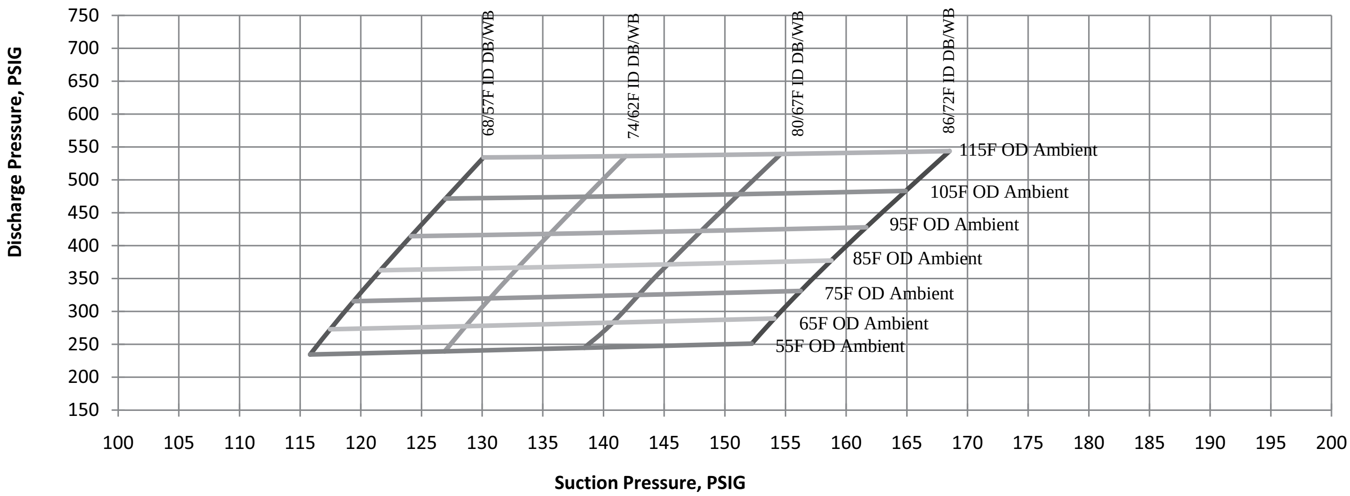
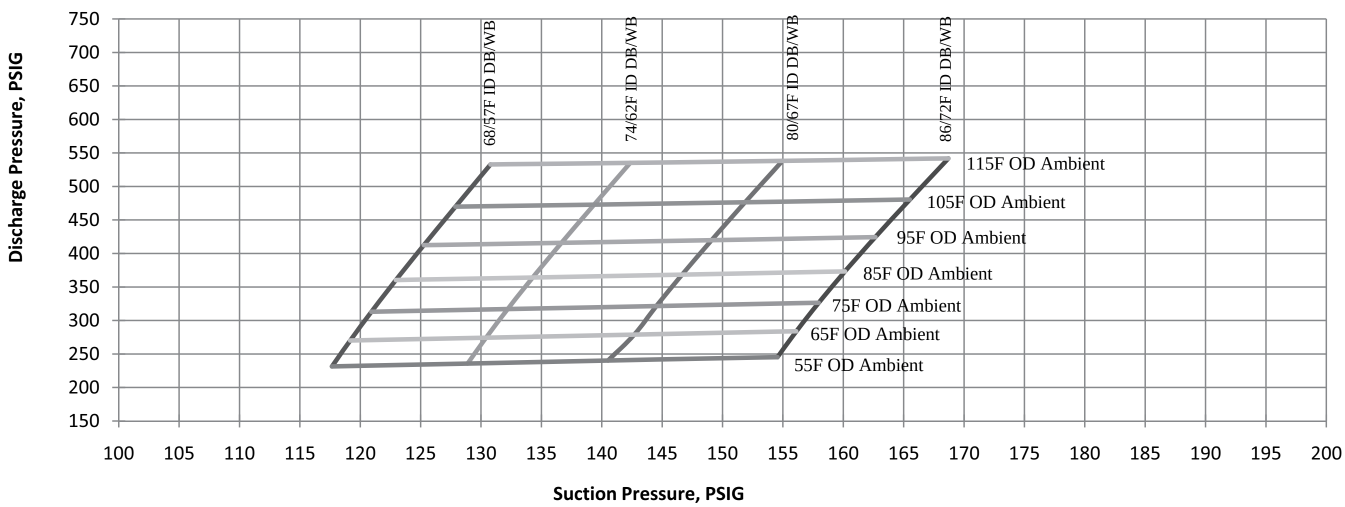
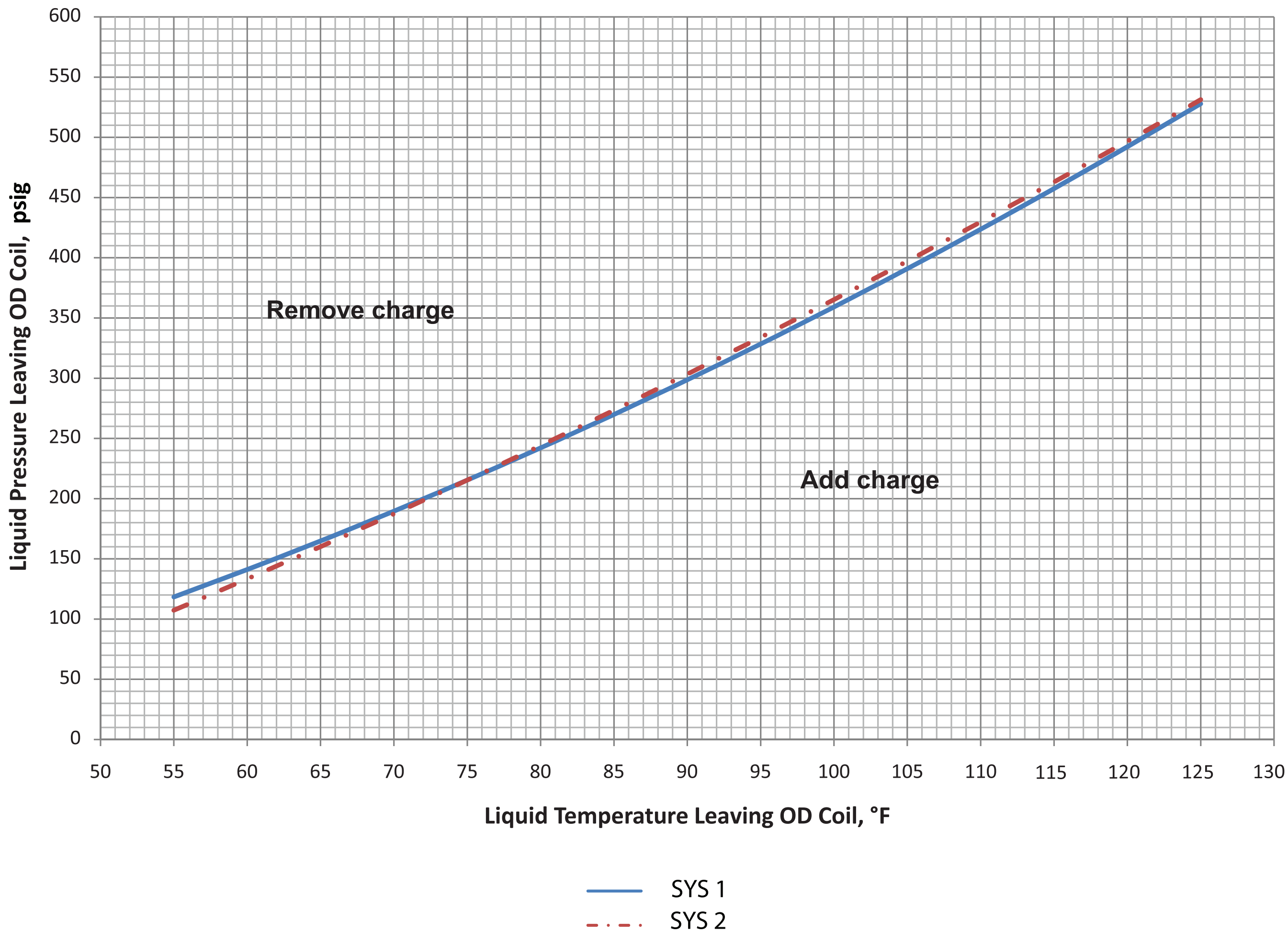



**Figure 2. T/YSC120F pressure curve system 2**



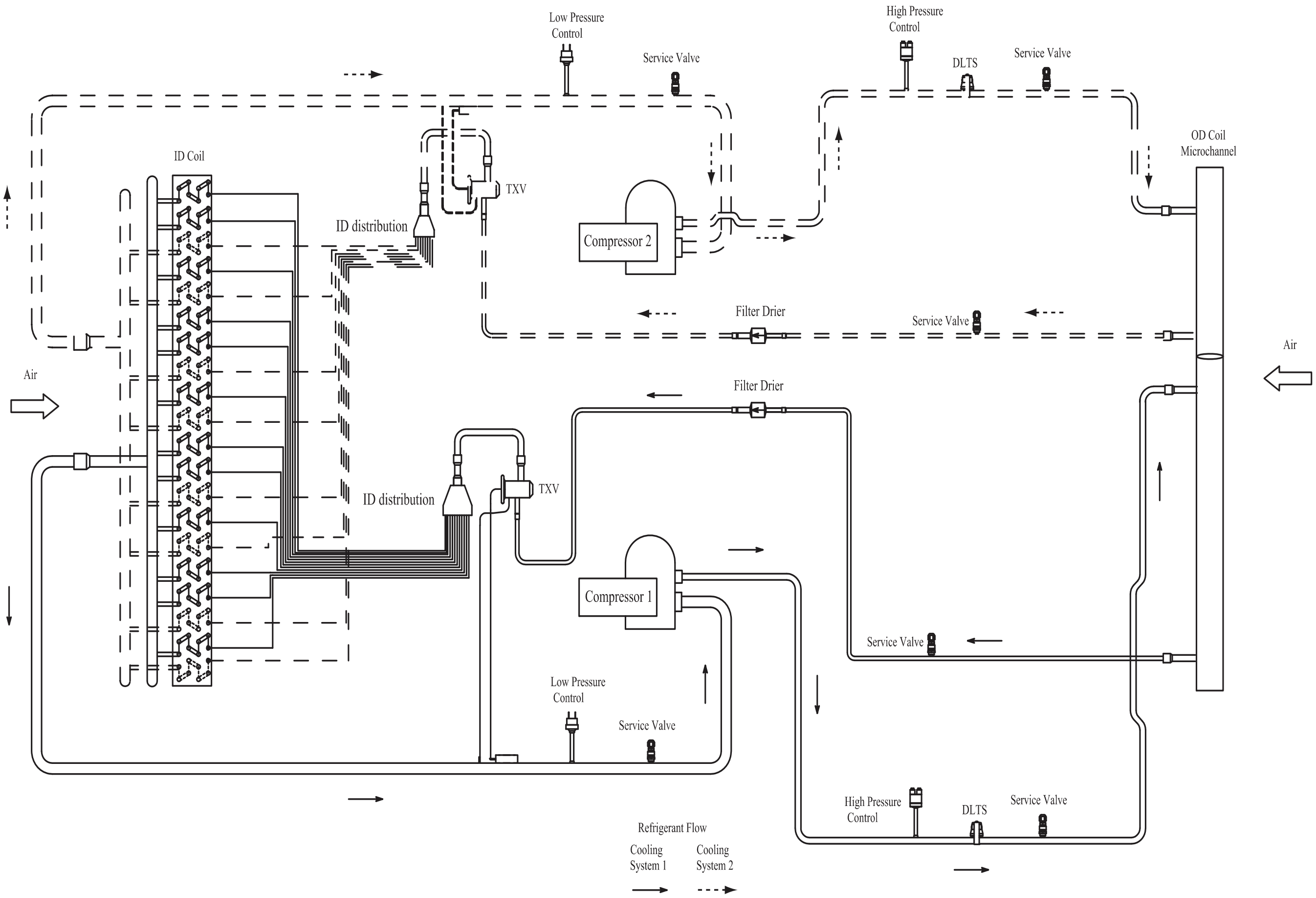
# Subcooling Charging Chart

**Figure 3. T/YSC120F subcooling charging chart - PSIG**



# Refrigerant Circuit

**Figure 4. T/YSC120F**



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