



Installation Instructions

CONTENTS

| | Page |
|--|-------|
| SAFETY CONSIDERATIONS | 1 |
| INSTALLATION | 1-24 |
| Step 1 — Rig and Place the Unit | 1 |
| • RIGGING | |
| • PLACING UNIT | |
| • MOUNTING UNIT | |
| Step 2 — Check Compressor Mounting | 3 |
| Step 3 — Cooler Fluid and Drain Piping Connections (Units Without Hydronic Packages) | 3 |
| • PREPARATION FOR YEAR-ROUND OPERATION | |
| • PREPARATION FOR WINTER SHUTDOWN | |
| Step 4 — Cooler Fluid and Drain Piping Connections (Units With Factory-Installed Hydronic Packages) | 12 |
| • WATER SYSTEM OVERVIEW | |
| • AIR SEPARATION | |
| • WATER CONNECTIONS | |
| • WATER SYSTEM CLEANING | |
| • SYSTEM PRESSURIZATION | |
| • FILLING THE SYSTEM | |
| Step 5 — Make Electrical Connections | 18 |
| • POWER SUPPLY | |
| • POWER WIRING | |
| • FIELD CONNECTIONS | |
| Step 6 — Install Accessories | 18 |
| • ELECTRICAL | |
| Step 7 — Refrigerant Circuit | 24 |
| • LEAK TESTING | |
| • DEHYDRATION | |
| • REFRIGERANT CHARGE | |
| APPENDIX A (Pressure Drop Curves, 30RA010-055) | 25-27 |

SAFETY CONSIDERATIONS


Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start up, and service this equipment (Fig. 1).

Untrained personnel can perform basic maintenance functions such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature and on tags, stickers, and labels attached to the equipment.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Keep quenching cloth and fire extinguisher nearby when brazing.
- Use care in handling, rigging, and setting bulky equipment. See Tables 1A-1D for Physical Data. Refer to Fig. 2 for unit weights.



ELECTRIC SHOCK HAZARD
 Open all remote disconnects before servicing this equipment.

INSTALLATION

Step 1 — Rig and Place the Unit

RIGGING — Preferred method is with spreader bars from above the unit. Use hooks in lifting holes. Rig at a single point with 4 cables or use spreader bars. All panels must be in place when rigging. See rigging label on unit for details concerning shipping weights, distance between lifting holes, center of gravity, and lifting ring dimensions. See Fig. 3.

If overhead rigging is not possible, place chiller on skid or pad for rolling or dragging. When rolling, use a minimum of 3 rollers. When dragging, pull the pad. *Do not apply force to the unit.* When in final position, raise from above to lift unit off pad.

⚠ CAUTION

All panels must be in place when rigging.

PLACING UNIT — There must be at least 3 ft (.9 m) for service and for unrestricted airflow on all non-coil sides of unit, and a minimum of 3.5 ft (1.1 m) clear air space on coil sides. For multiple units, allow 8 ft (2.48 m) separation between units for airflow and service.

MOUNTING UNIT — When unit is in proper location, use of mounting holes in base rails is recommended for securing unit to supporting structure, or for mounting unit on vibration isolators if required. See Fig. 3. Fasteners for mounting unit are field supplied. Be sure unit is level to within 1/8 in. per foot for proper oil return to compressor.

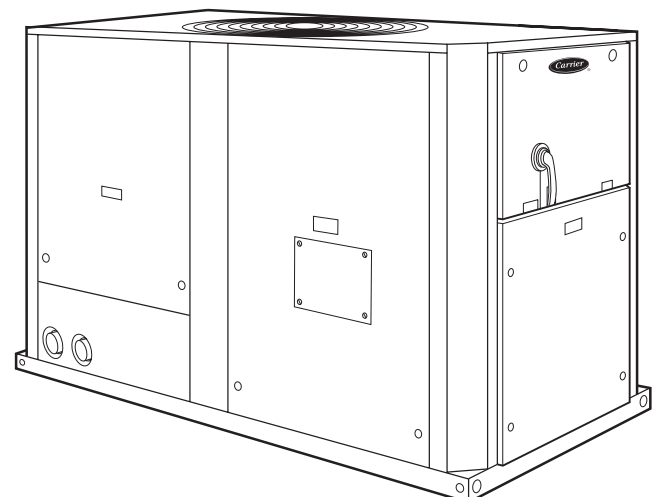
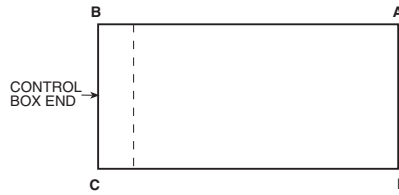


Fig. 1 — Typical 30RA Unit (010-018 Shown)



60 Hz

STD UNITS (without hydronic package)

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 182 | 210 | 255 | 299 | 946 |
| 015 | 197 | 245 | 291 | 335 | 1068 |
| 018 | 206 | 268 | 377 | 358 | 1209 |
| 022 | 336 | 451 | 381 | 355 | 1523 |
| 025 | 350 | 464 | 395 | 380 | 1589 |
| 030 | 378 | 518 | 409 | 400 | 1705 |
| 035 | 748 | 642 | 604 | 850 | 2844 |
| 040 | 763 | 653 | 616 | 882 | 2914 |
| 045 | 860 | 709 | 746 | 903 | 3218 |
| 050 | 876 | 721 | 770 | 946 | 3313 |
| 055 | 977 | 753 | 831 | 954 | 3515 |

| 30RA SIZE | KILOGRAMS — ALUMINUM | | | | |
|-----------|----------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 83 | 95 | 116 | 136 | 430 |
| 015 | 89 | 111 | 132 | 152 | 484 |
| 018 | 93 | 122 | 171 | 162 | 548 |
| 022 | 152 | 205 | 173 | 161 | 691 |
| 025 | 159 | 210 | 179 | 172 | 720 |
| 030 | 171 | 235 | 186 | 181 | 773 |
| 035 | 339 | 291 | 274 | 386 | 1290 |
| 040 | 346 | 296 | 279 | 400 | 1321 |
| 045 | 390 | 322 | 338 | 410 | 1460 |
| 050 | 397 | 327 | 349 | 429 | 1502 |
| 055 | 443 | 342 | 377 | 433 | 1595 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 194 | 231 | 274 | 326 | 1025 |
| 015 | 216 | 280 | 321 | 382 | 1199 |
| 018 | 220 | 303 | 411 | 404 | 1338 |
| 022 | 364 | 521 | 418 | 410 | 1713 |
| 025 | 380 | 532 | 432 | 436 | 1780 |
| 030 | 409 | 606 | 441 | 474 | 1930 |
| 035 | 854 | 721 | 691 | 958 | 3224 |
| 040 | 869 | 731 | 702 | 992 | 3294 |
| 045 | 965 | 790 | 833 | 1011 | 3599 |
| 050 | 978 | 805 | 859 | 1051 | 3693 |
| 055 | 1096 | 857 | 931 | 1082 | 3966 |

| 30RA SIZE | KILOGRAMS — COPPER | | | | |
|-----------|--------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 88 | 105 | 124 | 148 | 465 |
| 015 | 98 | 127 | 146 | 173 | 544 |
| 018 | 100 | 137 | 186 | 183 | 606 |
| 022 | 165 | 236 | 190 | 186 | 777 |
| 025 | 172 | 241 | 196 | 198 | 807 |
| 030 | 186 | 275 | 200 | 215 | 876 |
| 035 | 387 | 327 | 313 | 435 | 1462 |
| 040 | 394 | 332 | 318 | 450 | 1494 |
| 045 | 438 | 358 | 378 | 459 | 1633 |
| 050 | 444 | 365 | 390 | 477 | 1676 |
| 055 | 497 | 389 | 422 | 491 | 1799 |

50 Hz

STD UNITS (without hydronic package)

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 186 | 211 | 262 | 317 | 976 |
| 015 | 190 | 242 | 456 | 304 | 1192 |
| 018 | 205 | 268 | 378 | 358 | 1209 |
| 022 | 340 | 453 | 388 | 374 | 1555 |
| 025 | 354 | 468 | 410 | 398 | 1630 |
| 032 | 746 | 641 | 604 | 848 | 2839 |
| 035 | 768 | 652 | 620 | 911 | 2951 |
| 042 | 867 | 714 | 761 | 937 | 3279 |
| 045 | 886 | 729 | 800 | 985 | 3400 |

| 30RA SIZE | KILOGRAMS — ALUMINUM | | | | |
|-----------|----------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 84 | 96 | 119 | 144 | 443 |
| 015 | 86 | 110 | 207 | 138 | 541 |
| 018 | 93 | 122 | 171 | 162 | 548 |
| 022 | 154 | 205 | 176 | 170 | 705 |
| 025 | 161 | 212 | 186 | 181 | 740 |
| 032 | 338 | 291 | 274 | 385 | 1288 |
| 035 | 348 | 296 | 281 | 413 | 1338 |
| 042 | 393 | 324 | 345 | 425 | 1487 |
| 045 | 402 | 331 | 363 | 447 | 1543 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 198 | 232 | 281 | 346 | 1057 |
| 015 | 200 | 280 | 494 | 349 | 1323 |
| 018 | 219 | 304 | 412 | 403 | 1338 |
| 022 | 368 | 520 | 425 | 431 | 1744 |
| 025 | 382 | 534 | 448 | 456 | 1820 |
| 032 | 851 | 717 | 691 | 960 | 3219 |
| 035 | 872 | 729 | 708 | 1022 | 3331 |
| 042 | 968 | 795 | 851 | 1045 | 3659 |
| 045 | 1009 | 823 | 904 | 1115 | 3851 |

| 30RA SIZE | KILOGRAMS — COPPER | | | | |
|-----------|--------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 90 | 105 | 127 | 157 | 479 |
| 015 | 91 | 127 | 224 | 158 | 600 |
| 018 | 99 | 138 | 187 | 183 | 607 |
| 022 | 167 | 236 | 193 | 195 | 791 |
| 025 | 173 | 242 | 203 | 207 | 825 |
| 032 | 386 | 325 | 313 | 435 | 1459 |
| 035 | 396 | 331 | 321 | 464 | 1512 |
| 042 | 439 | 361 | 386 | 474 | 1660 |
| 045 | 458 | 373 | 410 | 506 | 1747 |

SINGLE PUMP UNITS

SINGLE PUMP UNITS

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 209 | 241 | 293 | 343 | 1086 |
| 015 | 223 | 277 | 329 | 379 | 1208 |
| 018 | 230 | 299 | 421 | 399 | 1349 |
| 022 | 367 | 492 | 416 | 368 | 1663 |
| 025 | 381 | 505 | 430 | 413 | 1729 |
| 030 | 409 | 561 | 443 | 433 | 1845 |
| 035 | 801 | 687 | 646 | 910 | 3044 |
| 040 | 815 | 698 | 658 | 943 | 3114 |
| 045 | 913 | 753 | 792 | 959 | 3418 |
| 050 | 929 | 765 | 816 | 1003 | 3513 |
| 055 | 1033 | 796 | 878 | 1008 | 3715 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 221 | 262 | 312 | 370 | 1165 |
| 015 | 242 | 312 | 359 | 426 | 1339 |
| 018 | 244 | 334 | 455 | 445 | 1478 |
| 022 | 395 | 562 | 453 | 443 | 1853 |
| 025 | 411 | 573 | 467 | 469 | 1920 |
| 030 | 440 | 649 | 475 | 507 | 2070 |
| 035 | 907 | 766 | 733 | 1018 | 3424 |
| 040 | 921 | 776 | 744 | 1053 | 3494 |
| 045 | 1018 | 834 | 879 | 1067 | 3799 |
| 050 | 1031 | 849 | 905 | 1108 | 3893 |
| 055 | 1152 | 900 | 978 | 1136 | 4166 |

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 213 | 241 | 300 | 362 | 1116 |
| 015 | 212 | 270 | 510 | 340 | 1332 |
| 018 | 229 | 299 | 422 | 399 | 1349 |
| 022 | 371 | 494 | 423 | 408 | 1695 |
| 025 | 384 | 508 | 445 | 432 | 1770 |
| 032 | 799 | 686 | 647 | 908 | 3039 |
| 035 | 820 | 696 | 662 | 973 | 3151 |
| 042 | 920 | 758 | 807 | 994 | 3479 |
| 045 | 938 | 772 | 847 | 1043 | 3600 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 225 | 262 | 319 | 391 | 1197 |
| 015 | 222 | 308 | 548 | 385 | 1463 |
| 018 | 243 | 335 | 456 | 444 | 1478 |
| 022 | 399 | 561 | 460 | 465 | 1884 |
| 025 | 412 | 574 | 483 | 490 | 1960 |
| 032 | 904 | 762 | 734 | 1020 | 3419 |
| 035 | 924 | 773 | 750 | 1084 | 3531 |
| 042 | 1021 | 839 | 897 | 1102 | 3859 |
| 045 | 1061 | 866 | 951 | 1173 | 4051 |

| 30RA SIZE | KILOGRAMS — ALUMINUM | | | | |
|-----------|----------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 96 | 110 | 136 | 165 | 507 |
| 015 | 96 | 123 | 231 | 154 | 604 |
| 018 | 104 | 136 | 191 | 181 | 612 |
| 022 | 168 | 223 | 192 | 185 | 768 |
| 025 | 175 | 230 | 202 | 197 | 804 |
| 032 | 362 | 311 | 293 | 412 | 1378 |
| 035 | 372 | 316 | 300 | 441 | 1429 |
| 042 | 417 | 344 | 366 | 451 | 1578 |
| 045 | 426 | 350 | 384 | 473 | 1633 |

| 30RA SIZE | KILOGRAMS — COPPER | | | | |
|-----------|--------------------|-----|-----|-----|--------------|
| | A | B | C | D | Total Weight |
| 010 | 102 | 119 | 144 | 178 | 543 |
| 015 | 101 | 140 | 248 | 174 | 663 |
| 018 | 110 | 152 | 207 | 202 | 671 |
| 022 | 181 | 254 | 209 | 210 | 854 |
| 025 | 187 | 260 | 219 | 223 | 889 |
| 032 | 410 | 345 | 332 | 462 | 1549 |
| 035 | 420 | 351 | 340 | 492 | 1603 |
| 042 | 463 | 381 | 407 | 500 | 1751 |
| 045 | 482 | 392 | 431 | 532 | 1837 |

DUAL PUMP UNITS

DUAL PUMP UNITS

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 226 | 262 | 316 | 372 | 1176 |
| 015 | 238 | 299 | 353 | 408 | 1298 |
| 018 | 244 | 320 | 448 | 427 | 1439 |
| 022 | 385 | 521 | 437 | 410 | 1753 |
| 025 | 399 | 533 | 451 | 436 | 1819 |
| 030 | 427 | 590 | 462 | 456 | 1935 |
| 035 | 825 | 707 | 666 | 936 | 3134 |
| 040 | 840 | 717 | 678 | 969 | 3204 |
| 045 | 938 | 773 | 813 | 984 | 3508 |
| 050 | 953 | 784 | 837 | 1029 | 3603 |
| 055 | 1057 | 816 | 899 | 1033 | 3805 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 238 | 283 | 335 | 399 | 1255 |
| 015 | 257 | 334 | 383 | 455 | 1429 |
| 018 | 258 | 355 | 482 | 473 | 1568 |
| 022 | 413 | 591 | 474 | 465 | 1943 |
| 025 | 429 | 601 | 488 | 492 | 2010 |
| 030 | 458 | 678 | 494 | 530 | 2160 |
| 035 | 931 | 786 | 753 | 1044 | 3514 |
| 040 | 946 | 795 | 764 | 1079 | 3584 |
| 045 | 1043 | 854 | 900 | 1092 | 3889 |
| 050 | 1055 | 868 | 926 | 1134 | 3983 |
| 055 | 1176 | 920 | 999 | 1161 | 4256 |

| 30RA SIZE | POUNDS — ALUMINUM | | | | |
|-----------|-------------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 213 | 241 | 300 | 362 | 1116 |
| 015 | 212 | 270 | 510 | 340 | 1332 |
| 018 | 229 | 299 | 422 | 399 | 1349 |
| 022 | 371 | 494 | 423 | 408 | 1695 |
| 025 | 384 | 508 | 445 | 432 | 1770 |
| 032 | 799 | 686 | 647 | 908 | 3039 |
| 035 | 820 | 696 | 662 | 973 | 3151 |
| 042 | 920 | 758 | 807 | 994 | 3479 |
| 045 | 938 | 772 | 847 | 1043 | 3600 |

| 30RA SIZE | POUNDS — COPPER | | | | |
|-----------|-----------------|-----|-----|------|--------------|
| | A | B | C | D | Total Weight |
| 010 | 241 | 282 | 342 | 421 | 1287 |
| 015 | 235 | 329 | 580 | 410 | 1553 |
| 018 | 257 | 356 | 483 | 472 | 1568 |
| 022 | 417 | 589 | 481 | 488 | 1974 |
| 025 | 430 | 601 | 505 | 514 | 2050 |
| 032 | 928 | 782 | 753 | 1046 | 3509 |
| 035 | 948 | 792 | 770 | 1111 | 3621 |
| 042 | 1045 | 858 | 918 | 1128 | 3949 |
| 045 | 1085 | 885 | 972 | 1199 | 4141 |

| 30RA SIZE |
|-----------|
|-----------|

Step 2 — Check Compressor Mounting — As shipped, each compressor is held down by 4 bolts. After unit is installed, verify mounting bolt torque 12 to 14 ft-lb.

Step 3 — Cooler Fluid and Drain Piping Connections (Units Without Hydronic Packages) — These chillers are supplied with factory-installed strainer (including blow-down valve) in the entering fluid piping and flow switch in the leaving fluid piping. Flow switch wiring is factory installed.

Piping connections are located on the left side of the chiller when facing the control panel for 010-030 sizes and at the end opposite the control panel for 032-055 sizes. See Fig. 4-9 depending on model.

All sizes have FPT connections as shown in the Physical Data tables. Provide a means of venting air from the high point of the field-installed piping as required. Install field-supplied drains in both the entering and leaving fluid connections.

After field piping is complete, freeze-up protection is recommended using inhibited ethylene glycol or other suitable inhibited antifreeze solution and electric heat tapes in areas where piping is exposed to low ambient temperatures (34 F [1 °C] or below). Heat tapes should possess a rating for area ambients and be covered with a suitable thickness of closed-cell insulation. Route power for heating tapes from a separately

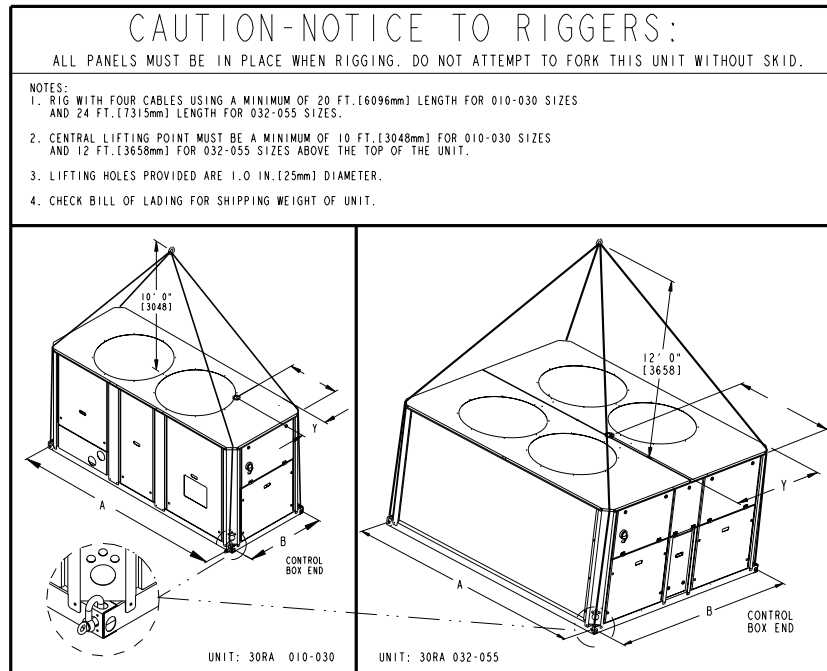
fused disconnect. Identify disconnect as heat tape power source with a warning that power must not be turned off except when unit is being serviced.

The cooler drain connection is at the opposite end from the compressor (see Fig. 4-9). Insulate the drain piping (in the same manner as the chilled water piping) for at least one ft (305 mm) from cooler.

PREPARATION FOR YEAR-ROUND OPERATION — If unit is in operation year-round, add sufficient inhibited ethylene glycol or other suitable inhibited antifreeze solution to chilled water to prevent freezing under low-ambient operating conditions. Consult local water treatment specialist on characteristics of water and recommended inhibitor.

PREPARATION FOR WINTER SHUTDOWN — *Do not shut off electrical disconnect during off-season shutdown.* At end of cooling season:

1. Position LOCAL/OFF/REMOTE switch to OFF.
2. Drain water from system.
3. Replace drain plug and put 2 gallons (8 liters) of inhibited ethylene glycol (or other suitable inhibited anti-freeze) in cooler to prevent freezing of residual water.
4. At the beginning of the next cooling season, refill cooler and add recommended inhibitor.



| UNIT | MAX SHIP WT W/O PACKAGING | | MAX SHIP WT W/ PACKAGING | | LIFTING HOLES | | | | CENTER OF GRAVITY | | | |
|-----------------|---------------------------|-----|--------------------------|-----|---------------|------|-------|------|-------------------|------|-------|-----|
| | Lb | Kg | Lb | Kg | in. | mm | in. | mm | in. | mm | in. | mm |
| 30RA010-60Hz | 937 | 425 | 1000 | 454 | 78.80 | 2001 | 40.00 | 1016 | 33.75 | 857 | 22.00 | 559 |
| 30RA010-60Hz C* | 1016 | 461 | 1079 | 489 | | | | | | | | |
| 30RA010-50Hz | 967 | 439 | 1030 | 467 | 78.80 | 2001 | 40.00 | 1016 | 33.75 | 857 | 22.22 | 559 |
| 30RA010-50Hz C* | 1048 | 475 | 1111 | 504 | | | | | | | | |
| 30RA015-60Hz | 1055 | 479 | 1118 | 507 | 78.80 | 2001 | 40.00 | 1016 | 34.00 | 864 | 21.50 | 546 |
| 30RA015-60Hz C* | 1186 | 538 | 1249 | 567 | | | | | | | | |
| 30RA015-50Hz | 1179 | 535 | 1242 | 563 | 78.80 | 2001 | 40.00 | 1016 | 29.75 | 756 | 17.87 | 454 |
| 30RA015-50Hz C* | 1310 | 594 | 1373 | 623 | | | | | | | | |
| 30RA018 | 1193 | 541 | 1256 | 570 | 78.80 | 2001 | 40.00 | 1016 | 32.12 | 816 | 20.12 | 511 |
| 30RA018 C* | 1322 | 600 | 1385 | 628 | | | | | | | | |
| 30RA022-60Hz | 1503 | 682 | 1591 | 722 | 105.44 | 2678 | 40.00 | 1016 | 42.25 | 1073 | 19.75 | 502 |
| 30RA022-60Hz C* | 1693 | 768 | 1781 | 808 | | | | | | | | |
| 30RA022-50Hz | 1535 | 696 | 1623 | 736 | 105.44 | 2678 | 40.00 | 1016 | 42.25 | 1073 | 19.75 | 502 |
| 30RA022-50Hz C* | 1724 | 782 | 1812 | 822 | | | | | | | | |
| 30RA025-60Hz | 1565 | 710 | 1653 | 750 | 105.44 | 2678 | 40.00 | 1016 | 42.25 | 1073 | 19.75 | 502 |
| 30RA025-60Hz C* | 1756 | 797 | 1844 | 836 | | | | | | | | |
| 30RA025-50Hz | 1606 | 728 | 1694 | 768 | 105.44 | 2678 | 40.00 | 1016 | 42.25 | 1073 | 19.75 | 502 |
| 30RA025-50Hz C* | 1796 | 815 | 1884 | 855 | | | | | | | | |
| 30RA030 | 1677 | 761 | 1765 | 801 | 105.44 | 2678 | 40.00 | 1016 | 42.25 | 1073 | 19.75 | 502 |
| 30RA030 C* | 1902 | 863 | 1990 | 903 | | | | | | | | |

| UNIT | MAX SHIP WT W/O PACKAGING | | MAX SHIP WT W/ PACKAGING | | LIFTING HOLES | | | | CENTER OF GRAVITY | | | |
|-----------------|---------------------------|------|--------------------------|------|---------------|------|-------|------|-------------------|------|-------|------|
| | Lb | Kg | Lb | Kg | in. | mm | in. | mm | in. | mm | in. | mm |
| 30RA032 | 2791 | 1266 | 2965 | 1345 | 105.44 | 2678 | 87.00 | 2210 | 43.87 | 1114 | 46.00 | 1168 |
| 30RA032 C* | 3171 | 1438 | 3345 | 1517 | | | | | | | | |
| 30RA035-60Hz | 2796 | 1268 | 2970 | 1347 | 105.44 | 2678 | 87.00 | 2210 | 43.87 | 1114 | 46.00 | 1168 |
| 30RA035-60Hz C* | 3176 | 1441 | 3376 | 1530 | | | | | | | | |
| 30RA035-50Hz | 2896 | 1314 | 3070 | 1393 | 105.44 | 2678 | 87.00 | 2210 | 43.87 | 1114 | 46.00 | 1168 |
| 30RA035-50Hz C* | 3276 | 1486 | 3450 | 1565 | | | | | | | | |
| 30RA040 | 2856 | 1295 | 3030 | 1374 | 105.44 | 2678 | 87.00 | 2210 | 43.87 | 1114 | 46.00 | 1168 |
| 30RA040 C* | 3236 | 1468 | 3410 | 1547 | | | | | | | | |
| 30RA042 | 3231 | 1466 | 3405 | 1544 | 105.44 | 2678 | 87.00 | 2210 | 43.75 | 1111 | 45.00 | 1143 |
| 30RA042 C* | 3611 | 1638 | 3785 | 1717 | | | | | | | | |
| 30RA045-60Hz | 3163 | 1435 | 3337 | 1514 | 105.44 | 2678 | 87.00 | 2210 | 43.75 | 1111 | 45.00 | 1143 |
| 30RA045-60Hz C* | 3544 | 1608 | 3718 | 1686 | | | | | | | | |
| 30RA045-50Hz | 3345 | 1517 | 3519 | 1596 | 105.44 | 2678 | 87.00 | 2210 | 43.75 | 1111 | 45.00 | 1143 |
| 30RA045-50Hz C* | 3796 | 1722 | 3970 | 1801 | | | | | | | | |
| 30RA050 | 3251 | 1475 | 3425 | 1554 | 105.44 | 2678 | 87.00 | 2210 | 43.75 | 1111 | 45.00 | 1143 |
| 30RA050 C* | 3631 | 1647 | 3805 | 1726 | | | | | | | | |
| 30RA055 | 3444 | 1562 | 3618 | 1641 | 105.44 | 2678 | 87.00 | 2210 | 43.75 | 1111 | 45.00 | 1143 |
| 30RA055 C* | 3895 | 1767 | 4069 | 1846 | | | | | | | | |

*C — Copper Finned Condenser Coil.

Fig. 3 — Unit Rigging Label Detail

Table 1A — Physical Data, 30RA — 60 Hz English

| UNIT 30RA | 010 | 015 | 018 | 022 | 025 | 030 | 035 | 040 | 045 | 050 | 055 |
|---|--|-----------|-----------|-------------------------|-----------|-----------|-----------------------------|-----------------------------|-------------------------|---------------------|---------------------|
| REFRIGERANT TYPE | R-22, TXV Controlled System | | | | | | | | | | |
| Refrigerant Charge (lb) Ckt A/Ckt B | 18/— | 27/— | 36/— | 37/— | 38/— | 48/— | 44/30 | 45/30 | 44/44 | 45/45 | 55/55 |
| COMPRESSORS | Scroll, Hermetic | | | | | | | | | | |
| Quantity | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 |
| Speed (Rpm) (Qty) Ckt A | (1) SM125 | (1) SM185 | (2) SM110 | (1) SM115, (1) SM160 | (2) SM160 | (2) SM185 | (1) SM115, (1) SM160 | (2) SM160 | (1) SM125, (1) SM160 | (2) SM160 | (2) SM185 |
| (Qty) Ckt B | — | — | — | — | — | — | (1) SM185 | (1) SM185 | (1) SM125, (1) SM160 | (2) SM160 | (2) SM185 |
| Oil Charge (Compressor/Pt) | SM110/5.7, SM115/6.7, SM125/6.7, SM160/7.0, SM185/11.6 | | | | | | | | | | |
| No. Capacity Steps | | | | | | | | | | | |
| Standard | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 |
| Optional (Maximum) | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 |
| Minimum Capacity Step (%) | | | | | | | | | | | |
| Standard | 100 | 100 | 50 | 42 | 50 | 50 | 25 | 32 | 22 | 25 | 25 |
| Optional | 69 | 79 | 32 | 27 | 38 | 39 | 16 | 24 | 15 | 19 | 20 |
| COOLER | Welded, Direct-Expansion Plate Heat Exchanger | | | | | | | | | | |
| Net Fluid Volume (gal) | 1.12 | 1.61 | 1.86 | 2.41 | 2.84 | 3.40 | 6.30 | 7.00 | 6.55 | 7.44 | 8.56 |
| Maximum Refrigerant Pressure (psig) | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| Maximum Fluid Side Pressure Without Pump(s) (psig) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Maximum Fluid Side Pressure With Pump(s) (psig) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| FLUID CONNECTIONS (in.) | | | | | | | | | | | |
| Inlet and Outlet, FPT | 2 | 2 | 2 | 2 | 2 | 2 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 |
| Drain (NPT) | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |
| CONDENSER FANS | | | | | | | | | | | |
| Standard Low Noise Type | | | | | | | | | | | |
| Fan Speed (Rpm) | 1140/570 | 1140/570 | 1140/570 | —/850 | —/850 | —/850 | —/850 | —/850 | —/850 | —/850 | —/850 |
| Standard/Low Noise | | | | | | | | | | | |
| No. Blades...Diameter (in.) Ckt A/Ckt B | 15...30/— | 15...30/— | 15...30/— | 11...30/— | 11...30/— | 11...30/— | 11...30/ 11...30 | 11...30/ 11...30 | 11...30/ 11...30 | 11...30/ 11...30 | 11...30/ 11...30 |
| No. Fans...Total kW | 1...1.8 | 1...1.8 | 1...1.8 | 2...2.0 | 2...2.0 | 2...2.0 | 2...2.0 (A), 1...1.8 (B) | 2...2.0 (A), 1...1.8 (B) | 4...4.0 | 4...4.0 | 4...4.0 |
| Total Airflow (Cfm) | 10,500 | 10,500 | 10,500 | 13,600 | 13,600 | 14,500 | 21,000 | 21,000 | 27,300 | 27,300 | 29,000 |
| CONDENSER COILS | | | | | | | | | | | |
| Quantity...No. Rows | 1...2 | 1...3 | 1...3 | 1...3 | 1...3 | 1...3 | 2...3 | 2...3 | 2...3 | 2...3 | 2...3 |
| Total Face Area (sq ft) | 23 | 23 | 23 | 32 | 32 | 40 | 55 | 55 | 64 | 64 | 80 |
| HYDRONIC MODULE (Optional)* | Pump(s), Strainer W/Blowdown Valve, Expansion Tank, Pressure Gages, Drain and Vent Plugs, Flow Switch, and Balance Valve | | | | | | | | | | |
| Pump | Single or Dual, Close-Coupled Centrifugal Pump(s), 3500 Rpm | | | | | | | | | | |
| Expansion Tank Volume (gal) | 4.4 | | | | | | 10.3 | | | | |

Table 1B — Physical Data, 30RA — 50 Hz English

| UNIT 30RA | 010 | 015 | 018 | 022 | 025 | 032 | 035 | 042 | 045 |
|---|--|-----------|-----------|-----------|-----------|-----------------------------|-----------------------------|---------------------|---------------------|
| REFRIGERANT TYPE | R-22, TXV Controlled System | | | | | | | | |
| Refrigerant Charge (lb) Ckt A/Ckt B | 18/— | 27/— | 36/— | 37/— | 38/— | 44/30 | 44/30 | 44/44 | 44/44 |
| COMPRESSORS | Scroll, Hermetic | | | | | | | | |
| Quantity | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 |
| Speed (Rpm) (Qty) Ckt A | (1) SM160 | (2) SM110 | (2) SM125 | (2) SM160 | (2) SM185 | (1) SM115, (1) SM160 | (2) SM185 | (2) SM160 | (2) SM185 |
| (Qty) Ckt B | — | — | — | — | — | (1) SM185 | (1) SM185 | (2) SM160 | (2) SM185 |
| Oil Charge (Compressor/Pt) | SM110/5.7, SM115/6.7, SM125/6.7, SM160/7.0, SM185/11.6 | | | | | | | | |
| No. Capacity Steps | | | | | | | | | |
| Standard | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 |
| Optional (Maximum) | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 |
| Minimum Capacity Step (%) | | | | | | | | | |
| Standard | 100 | 50 | 50 | 50 | 40 | 25 | 33 | 25 | 25 |
| Optional | 71 | 28 | 31 | 35 | 37 | 15 | 25 | 18 | 19 |
| COOLER | Welded, Direct-Expansion Plate Heat Exchanger | | | | | | | | |
| Net Fluid Volume (gal) | 1.12 | 1.61 | 1.86 | 2.41 | 2.84 | 5.77 | 6.55 | 6.77 | 6.55 |
| Maximum Refrigerant Pressure (psig) | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| Maximum Fluid Side Pressure Without Pump(s) (psig) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Maximum Fluid Side Pressure With Pump(s) (psig) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| FLUID CONNECTIONS (in.) | | | | | | | | | |
| Inlet and Outlet, FPT | 2 | 2 | 2 | 2 | 2 | 2 1/2 | 2 1/2 | 2 1/2 | 2 1/2 |
| Drain (NPT) | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |
| CONDENSER FANS | | | | | | | | | |
| Standard Low Noise Type | | | | | | | | | |
| Fan Speed (Rpm) | 950/475 | 950/475 | 950/475 | —/700 | —/700 | —/700 | —/700 | —/700 | —/700 |
| Standard/Low Noise | | | | | | | | | |
| No. Blades...Diameter (in.) Ckt A/Ckt B | 15...30/— | 15...30/— | 15...30/— | 11...30/— | 11...30/— | 11...30/ 11...30 | 11...30/ 11...30 | 11...30/ 11...30 | 11...30/ 11...30 |
| No. Fans...Total kW | 1...1.8 | 1...1.8 | 1...1.8 | 2...2.0 | 2...2.0 | 2...2.0 (A), 1...1.8 (B) | 2...2.0 (A), 1...1.8 (B) | 4...4.0 | 4...4.0 |
| Total Airflow (Cfm) | 8,750 | 8,750 | 8,750 | 11,330 | 11,330 | 17,500 | 17,500 | 22,750 | 22,750 |
| CONDENSER COILS | | | | | | | | | |
| Quantity...No. Rows | 1...2 | 1...3 | 1...3 | 1...3 | 1...3 | 2...3 | 2...3 | 2...3 | 2...3 |
| Total Face Area (sq ft) | 23 | 23 | 23 | 32 | 32 | 55 | 55 | 64 | 64 |
| HYDRONIC MODULE (Optional)* | Pump(s), Strainer W/Blowdown Valve, Expansion Tank, Pressure Gages, Drain and Vent Plugs, Flow Switch, and Balance Valve | | | | | | | | |
| Pump | Single or Dual, Close-Coupled Centrifugal Pump(s), 2900 Rpm | | | | | | | | |
| Expansion Tank Volume (gal) | 4.4 | | | | | | 10.3 | | |

LEGEND

TXV — Thermostatic Expansion Valve

*Flow switch and strainer are standard on all units, with or without hydronic package.

NOMINAL INPUT HP FOR COMPRESSORS

| COMPRESSOR | 60 Hz | 50 Hz |
|------------|-------|-------|
| SM110 | 12.5 | 10.5 |
| SM115 | 13.5 | 11.2 |
| SM125 | 14.7 | 12.0 |
| SM160 | 19.1 | 15.6 |
| SM185 | 21.8 | 18.3 |

Table 1C — Physical Data, 30RA — 60 Hz SI

| UNIT 30RA | 010 | 015 | 018 | 022 | 025 | 030 | 035 | 040 | 045 | 050 | 055 |
|--|--|------------|------------|-------------------------|------------|------------|-----------------------------|-----------------------------|-------------------------|-----------------------|-----------------------|
| REFRIGERANT TYPE | R-22, TXV Controlled System | | | | | | | | | | |
| Refrigerant Charge (kg) Ckt A/Ckt B | 8.2/— | 12.2/— | 16.3/— | 16.8/— | 17.2/— | 21.8/— | 20.0/13.6 | 20.4/13.6 | 20.0/20.0 | 20.4/20.4 | 25.0/25.0 |
| COMPRESSORS | Scroll, Hermetic | | | | | | | | | | |
| Quantity | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 |
| Speed (r/s) | 58.3 | | | | | | | | | | |
| (Qty) Ckt A | (1) SM125 | (1) SM185 | (2) SM110 | (1) SM115, (1) SM160 | (2) SM160 | (2) SM185 | (1) SM115, (1) SM160 | (2) SM160 | (1) SM125, (1) SM160 | (2) SM160 | (2) SM185 |
| (Qty) Ckt B | — | — | — | — | — | — | (1) SM185 | (1) SM185 | (1) SM125, (1) SM160 | (2) SM160 | (2) SM185 |
| Oil Charge (Compressor/L) | SM110/2.7, SM115/3.2, SM125/3.2, SM160/3.3, SM185/5.5 | | | | | | | | | | |
| No. Capacity Steps | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 |
| Standard | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 |
| Optional (Maximum) | 100 | 100 | 50 | 42 | 50 | 50 | 25 | 32 | 22 | 25 | 25 |
| Minimum Capacity Step (%) | 69 | 79 | 32 | 27 | 38 | 39 | 16 | 24 | 15 | 19 | 20 |
| Optional | | | | | | | | | | | |
| COOLER | Welded, Direct-Expansion Plate Heat Exchanger | | | | | | | | | | |
| Net Fluid Volume (L) | 4.22 | 6.08 | 7.03 | 9.12 | 10.75 | 12.84 | 26.49 | 24.79 | 28.12 | 32.34 | 32.34 |
| Maximum Refrigerant Pressure (kPa) | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 |
| Maximum Fluid Side Pressure Without Pump(s) (kPa) | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 |
| Maximum Fluid Side Pressure With Pump(s) (kPa) | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 |
| FLUID CONNECTIONS (mm) | | | | | | | | | | | |
| Inlet and Outlet, FPT | 50.8 | 50.8 | 50.8 | 50.8 | 50.8 | 50.8 | 63.5 | 63.5 | 63.5 | 63.5 | 63.5 |
| Drain (NPT) | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 |
| CONDENSER FANS | | | | | | | | | | | |
| Standard Low Noise Type | | | | | | | | | | | |
| Fan Speed (r/s) | 19/9.5 | 19/9.5 | 19/9.5 | —/14.2 | —/14.2 | —/14.2 | —/14.2 | —/14.2 | —/14.2 | —/14.2 | —/14.2 |
| Standard/Low Noise | | | | | | | | | | | |
| No. Blades...Diameter (mm) Ckt A/Ckt B | 15...762/— | 15...762/— | 15...762/— | 11...762/— | 11...762/— | 11...762/— | 11...762/ 15...762 | 11...762/ 15...762 | 11...762/ 11...762 | 11...762/ 11...762 | 11...762/ 11...762 |
| No. Fans...Total kW | 1...1.8 | 1...1.8 | 1...1.8 | 2...2.0 | 2...2.0 | 2...2.0 | 2...2.0 (A), 1...1.8 (B) | 2...2.0 (A), 1...1.8 (B) | 4...4.0 | 4...4.0 | 4...4.0 |
| Total Airflow (L/s) | 4,955 | 4,955 | 4,955 | 6,419 | 6,419 | 6,843 | 9,595 | 9,595 | 12,884 | 12,884 | 13,687 |
| CONDENSER COILS | | | | | | | | | | | |
| Quantity...No. Rows | 1...2 | 1...3 | 1...3 | 1...3 | 1...3 | 1...3 | 2...3 | 2...3 | 2...3 | 2...3 | 2...3 |
| Total Face Area (sq m) | 2.14 | 2.14 | 2.14 | 2.97 | 2.97 | 3.72 | 5.11 | 5.11 | 5.95 | 5.95 | 7.43 |
| HYDRONIC MODULE (Optional)* | Pump(s), Strainer W/Blowdown Valve, Expansion Tank, Pressure Gages, Drain and Vent Plugs, Flow Switch, and Balance Valve | | | | | | | | | | |
| Pump | Single or Dual, Close-Coupled Centrifugal Pump(s), 58.3 r/s | | | | | | | | | | |
| Expansion Tank Volume (L) | 16.5 | | | | | | 39 | | | | |

Table 1D — Physical Data, 30RA — 50 Hz SI

| UNIT 30RA | 010 | 015 | 018 | 022 | 025 | 032 | 035 | 042 | 045 |
|--|--|------------|------------|------------|------------|-----------------------------|-----------------------------|-----------------------|-----------------------|
| REFRIGERANT TYPE | R-22, TXV Controlled System | | | | | | | | |
| Refrigerant Charge (kg) Ckt A/Ckt B | 8.2/— | 12.2/— | 16.3/— | 16.8/— | 17.2/— | 20.0/13.6 | 20.0/13.6 | 20.0/20.0 | 20.0/20.0 |
| COMPRESSORS | Scroll, Hermetic | | | | | | | | |
| Quantity | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 |
| Speed (r/s) | 48.3 | | | | | | | | |
| (Qty) Ckt A | (1) SM160 | (2) SM110 | (2) SM125 | (2) SM160 | (2) SM185 | (1) SM115, (1) SM160 | (2) SM185 | (2) SM160 | (2) SM185 |
| (Qty) Ckt B | — | — | — | — | — | (1) SM185 | (1) SM185 | (2) SM160 | (2) SM185 |
| Oil Charge (Compressor/L) | SM110/2.7, SM115/3.2, SM125/3.2, SM160/3.3, SM185/5.5 | | | | | | | | |
| No. Capacity Steps | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 |
| Standard | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 |
| Optional (Maximum) | 100 | 50 | 50 | 50 | 50 | 25 | 33 | 25 | 25 |
| Minimum Capacity Step (%) | 71 | 28 | 31 | 35 | 37 | 15 | 25 | 18 | 19 |
| Optional | | | | | | | | | |
| COOLER | Welded, Direct-Expansion Plate Heat Exchanger | | | | | | | | |
| Net Fluid Volume (L) | 4.22 | 6.08 | 7.03 | 9.12 | 10.75 | 21.82 | 24.77 | 21.82 | 24.77 |
| Maximum Refrigerant Pressure (psig) | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 | 3103 |
| Maximum Fluid Side Pressure Without Pump(s) (kPa) | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 |
| Maximum Fluid Side Pressure With Pump(s) (kPa) | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 | 1034 |
| FLUID CONNECTIONS (mm) | | | | | | | | | |
| Inlet and Outlet, FPT | 50.8 | 50.8 | 50.8 | 50.8 | 50.8 | 63.5 | 63.5 | 63.5 | 63.5 |
| Drain (NPT) | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 |
| CONDENSER FANS | | | | | | | | | |
| Standard Low Noise Type | | | | | | | | | |
| Fan Speed (r/s) | 15.8/7.9 | 15.8/7.9 | 15.8/7.9 | —/11.7 | —/11.7 | —/11.7 | —/11.7 | —/11.7 | —/11.7 |
| Standard/Low Noise | | | | | | | | | |
| No. Blades...Diameter (mm) Ckt A/Ckt B | 15...762/— | 15...762/— | 15...762/— | 11...762/— | 11...762/— | 11...762/ 11...762 | 11...762/ 15...762 | 11...762/ 15...762 | 11...762/ 11...762 |
| No. Fans...Total kW | 1...1.8 | 1...1.8 | 1...1.8 | 2...2.0 | 2...2.0 | 2...2.0 (A), 1...1.8 (B) | 2...2.0 (A), 1...1.8 (B) | 4...4.0 | 4...4.0 |
| Total Airflow (L/s) | 4,130 | 4,130 | 4,130 | 5,349 | 5,349 | 7,995 | 7,995 | 10,737 | 10,737 |
| CONDENSER COILS | | | | | | | | | |
| Quantity...No. Rows | 1...2 | 1...3 | 1...3 | 1...3 | 1...3 | 2...3 | 2...3 | 2...3 | 2...3 |
| Total Face Area (sq m) | 2.14 | 2.14 | 2.14 | 2.97 | 2.97 | 5.11 | 5.11 | 5.95 | 5.95 |
| HYDRONIC MODULE (Optional)* | Pump(s), Strainer W/Blowdown Valve, Expansion Tank, Pressure Gages, Drain and Vent Plugs, Flow Switch, and Balance Valve | | | | | | | | |
| Pump | Single or Dual, Close-Coupled Centrifugal Pump(s), 48.3 r/s | | | | | | | | |
| Expansion Tank Volume (L) | 16.5 | | | | | 39 | | | |

LEGEND

TXV — Thermostatic Expansion Valve

*Flow switch and strainer are standard on all units, with or without hydronic package.

NOMINAL INPUT HP FOR COMPRESSORS

| COMPRESSOR | 60 Hz | 50 Hz |
|------------|-------|-------|
| SM110 | 12.5 | 10.5 |
| SM115 | 13.5 | 11.2 |
| SM125 | 14.7 | 12.0 |
| SM160 | 19.1 | 15.6 |
| SM185 | 21.8 | 18.3 |

- NOTES:**
- Unit must have clearances for airflow as follows:
 Top — Do not restrict in any way.
 Coil Side — 3 1/2 ft [1067 mm] from solid surface side.
 Ends — 3 ft [914 mm] from solid surface (for service access).
 Coil side clearance with accessory hail guard installed is 3 ft [914 mm] to outside edge of hail guard top panel.
 Coil side clearance for multiple chiller installation is 6 ft [1981 mm].
 - Flow switch is factory installed in leaving fluid piping. Strainer is factory installed for entering fluid piping.

| UNIT | DIM. A | DIM. B | DIM. C |
|--------------|-------------|-------------|-------------|
| 30RA010-60HZ | 33.75 [857] | 22.00 [559] | 21.00 [533] |
| 30RA010-50HZ | 33.75 [857] | 22.00 [559] | 21.00 [533] |
| 30RA015-60HZ | 34.00 [864] | 21.50 [546] | 21.00 [533] |
| 30RA015-50HZ | 29.75 [756] | 17.87 [454] | 21.00 [533] |
| 30RA018-60HZ | 32.12 [816] | 20.12 [511] | 21.00 [533] |
| 30RA018-50HZ | | | |

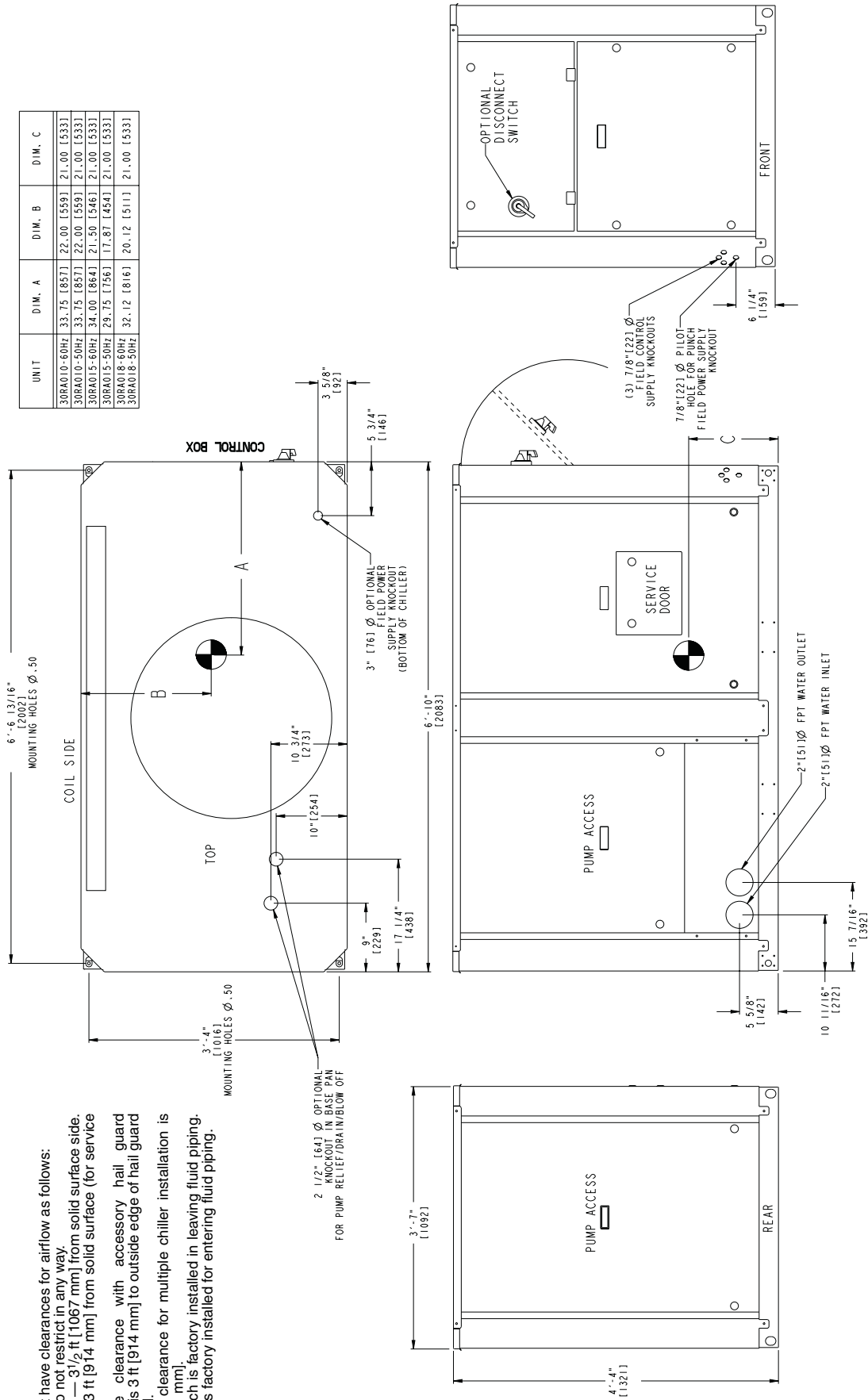


Fig. 4 — Dimensions — 30RA010,015,018 AquaSnap™ Chiller

- NOTES:**
- Unit must have clearances for airflow as follows:
 Top — Do not restrict in any way.
 Coil Side — 3 1/2 ft [1067 mm] from solid surface side.
 Ends — 3 ft [914 mm] from solid surface (for service access).
 2. Coil side clearance with accessory hall guard installed is 3 ft [914 mm] to outside edge of hall guard top panel.
 3. Coil side clearance for multiple chiller installation is 6 ft [1881 mm].
 4. Flow switch is factory installed in leaving fluid piping. Strainer is factory installed for entering fluid piping.

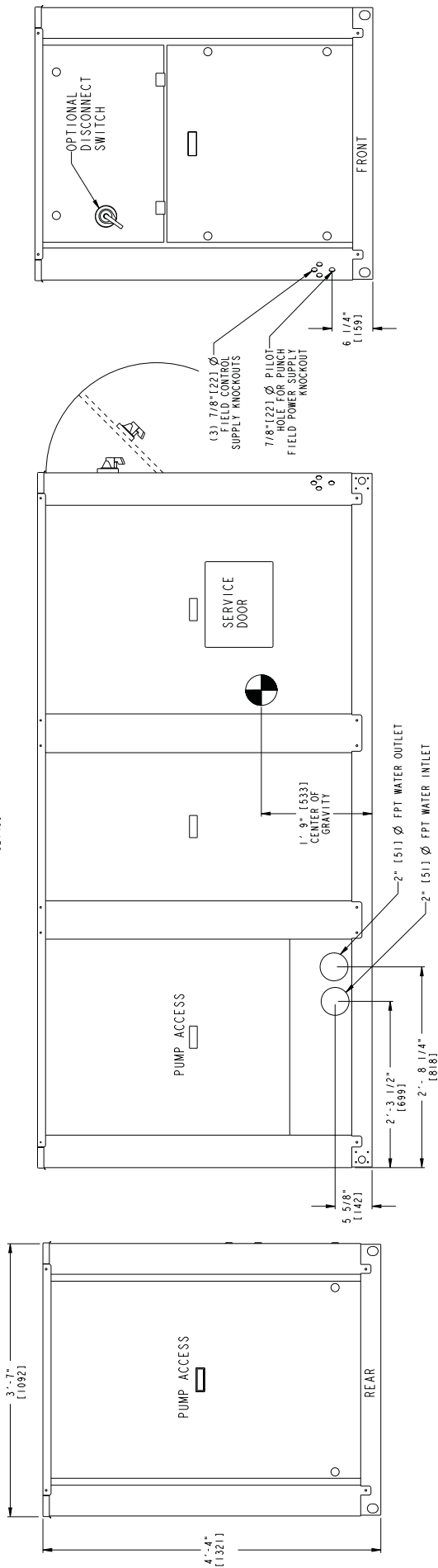
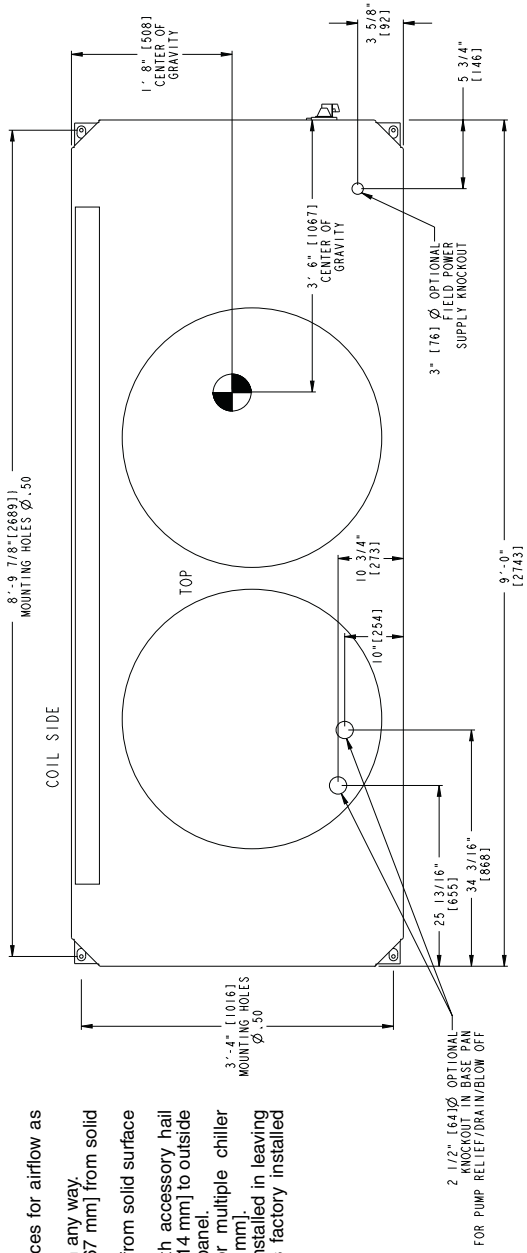
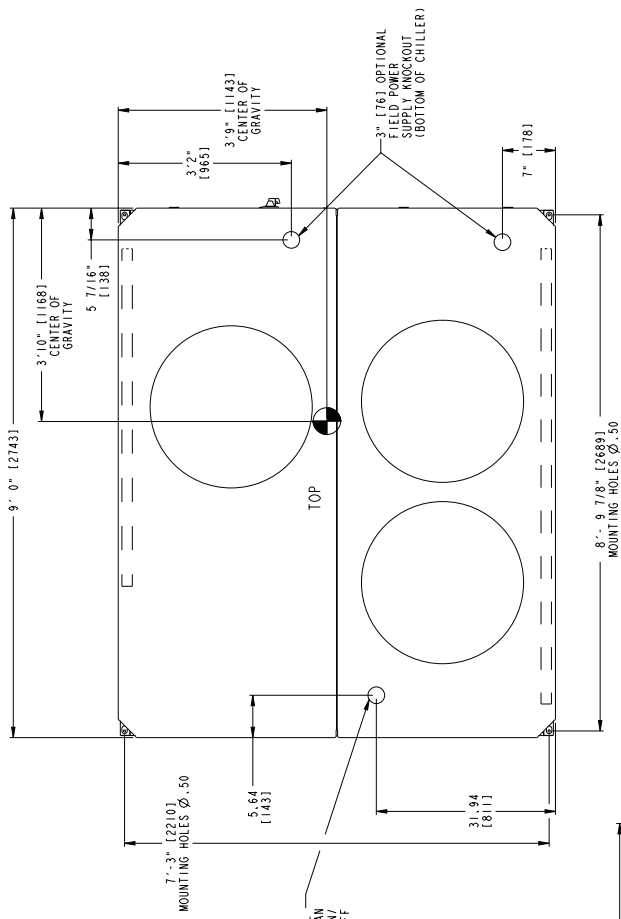


Fig. 5 — Dimensions — 30RA022,025 AquaSnap™ Chiller

- NOTES:**
- Unit must have clearances for airflow as follows:
 Top — Do not restrict in any way.
 Coil Side — 3 1/2 ft [1067 mm] from solid surface side.
 Ends — 3 ft [914 mm] from solid surface (for service access).
 - Coil side clearance with accessory hail guard installed is 3 ft [914 mm] to outside edge of hail guard top panel.
 - Coil side clearance for multiple chiller installation is 6 ft [1981 mm].
 - Flow switch is factory installed in leaving fluid piping.
 Strainer is factory installed for entering fluid piping.



Ø 1 3/4" [441] OPTIONAL KNOCKOUT IN BASE PAN FOR PUMP RELIEF/DRAIN/BLOW OFF

3" [76] OPTIONAL FIELD POWER KNOCKOUT (BOTTOM OF CHILLER)

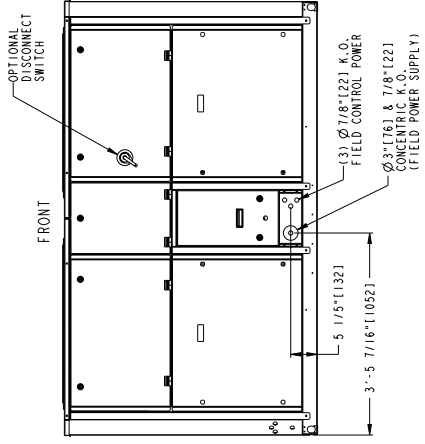
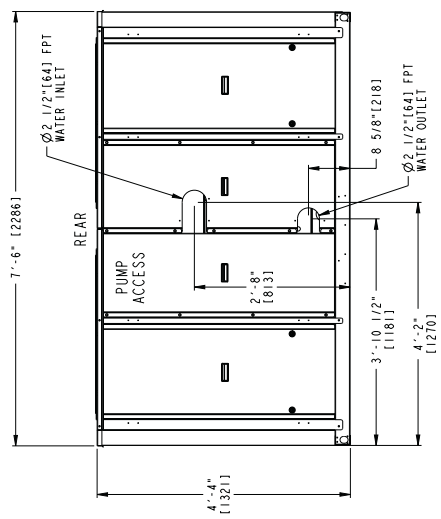


Fig. 7 — Dimensions — 30RA032-040 AquaSnap™ Chiller

- NOTES:**
- Unit must have clearances for airflow as follows:
 Top — Do not restrict in any way.
 Coil Side — 3 1/2 ft [1067 mm] from solid surface side.
 Ends — 3 ft [914 mm] from solid surface (for service access).
 - Coil side clearance with accessory hail guard installed is 3 ft [914 mm] to outside edge of hail guard top panel.
 - Coil side clearance for multiple chiller installation is 6 ft [1881 mm].
 - Flow switch is factory installed in leaving fluid piping.
 Strainer is factory installed for entering fluid piping.

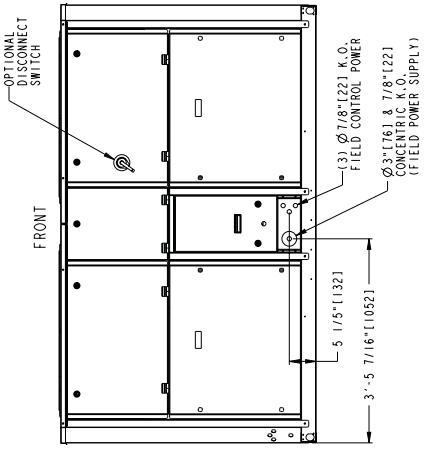
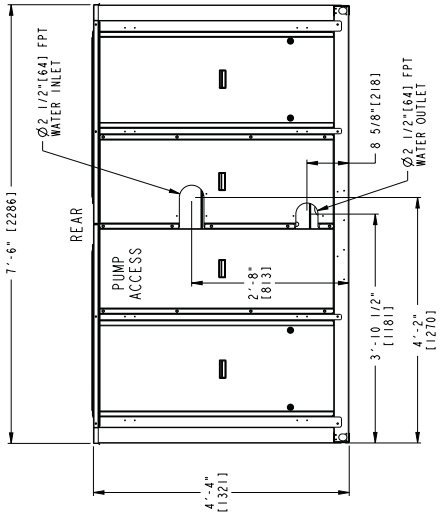
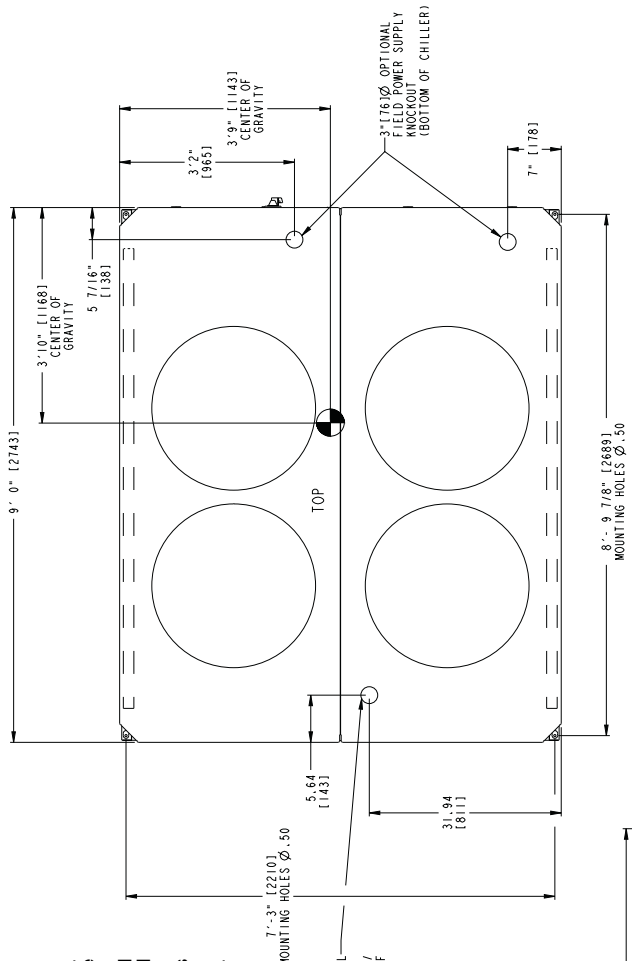


Fig. 8 — Dimensions — 30RA042-050 AquaSnap™ Chiller

- NOTES:**
- Unit must have clearances for airflow as follows:
 - Top — Do not restrict in any way.
 - Coil Side — 3 1/2 ft [1067 mm] from solid surface side.
 - Ends — 3 ft [914 mm] from solid surface (for service access).
 - Coil side clearance with accessory hail guard installed is 3 ft [914 mm] to outside edge of hail guard top panel.
 - Coil side clearance for multiple chiller installation is 6 ft [1981 mm].
 - Flow switch is factory installed in leaving fluid piping. Strainer is factory installed for entering fluid piping.

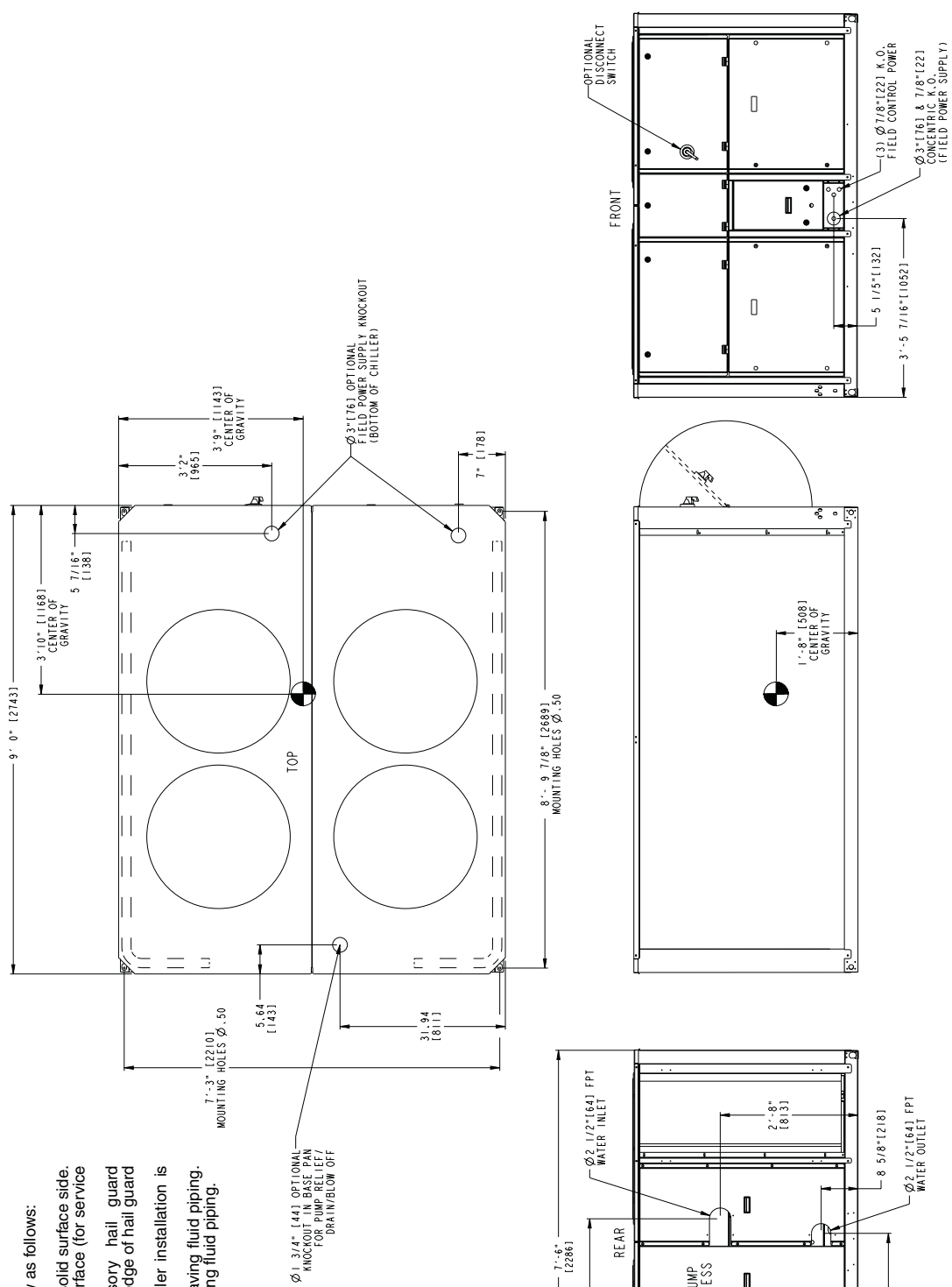


Fig. 9 — Dimensions — 30RA055 AquaSnap™ Chiller

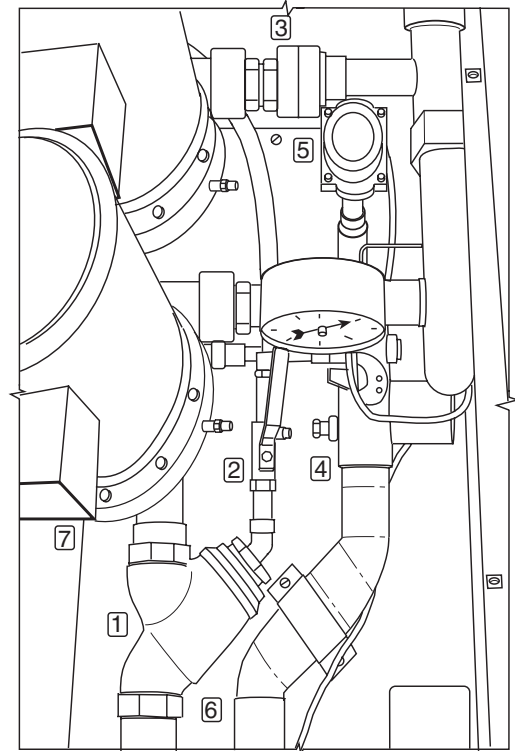
Step 4 — Cooler Fluid and Drain Piping Connections (Units with Factory-Installed Hydronic Packages)

WATER SYSTEM OVERVIEW — The 30RA chillers with factory-installed hydronic packages are designed for use with closed systems, meaning that there is no more than one water-air interface in the water loop. Cooling tower loops, for example, have two water-air interfaces (sump and nozzles) and would thus be classified as open, whereas a correctly designed chilled water loop with the only water-air interface being in the expansion tank is closed. Since closed and open water systems behave very differently, these instructions assume that the chilled water loop is closed. A system installed incorrectly such that air is not handled properly — pipe leaks, vent leaks, air in pipes, etc. — may behave as an open system and thus have unsatisfactory operation. Pump seal wear can also cause leaks that cause poor system operation.

Proper closed system design and installation procedures should be followed closely. The system must be constructed with pressure tight components and thoroughly tested for installation leaks. Factory-supplied hydronic systems are available with single or dual (for back-up) pumps. The factory-installed system includes all of the components within the dashed lines in Fig. 10.

Installation of water systems should follow sound engineering practice as well as applicable local and industry standards. Improperly designed or installed systems may cause unsatisfactory operation and/or system failure. Consult a water treatment specialist or appropriate literature for information regarding filtration, water treatment, and control devices. Figure 10 shows a typical installation with components that might be installed with the hydronic package of the 30RA unit. Figure 11 illustrates a typical dual pump package for the 010-030 size models.

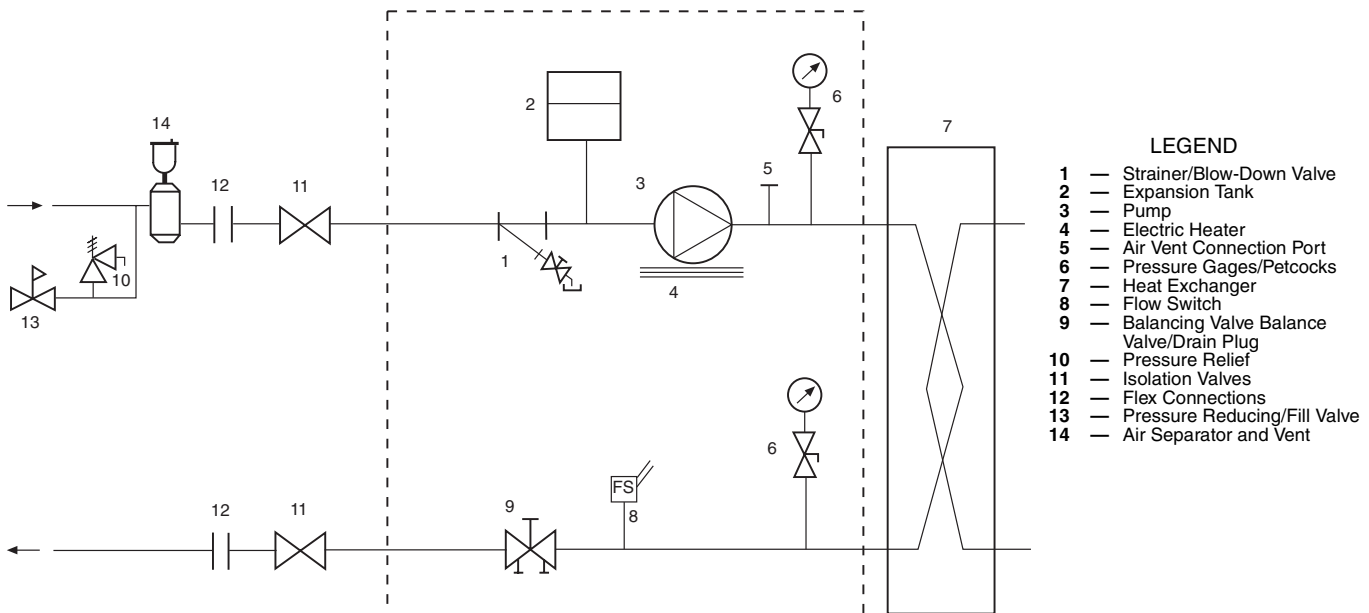
NOTE: It is recommended that isolation (shut-off) valves be placed exterior to the unit to allow removal and service of the entire pump assembly, if necessary. Also, if the unit is isolated with valves, a properly sized pressure relief valve should be installed in the piping between the unit and the valves, following all applicable state and local codes.



LEGEND

- | | |
|---|-----------------------|
| 1 — Strainer | 5 — Flow Switch |
| 2 — Blow-Down Valve | 6 — Field Connections |
| 3 — Discharge Check Valve (Dual Pumps Only) | 7 — Heater |
| 4 — Balancing Valve with Drain Plug | |

Fig. 11 — Typical Dual Pump Package



LEGEND

- | |
|--|
| 1 — Strainer/Blow-Down Valve |
| 2 — Expansion Tank |
| 3 — Pump |
| 4 — Electric Heater |
| 5 — Air Vent Connection Port |
| 6 — Pressure Gages/Petcocks |
| 7 — Heat Exchanger |
| 8 — Flow Switch |
| 9 — Balancing Valve Balance Valve/Drain Plug |
| 10 — Pressure Relief |
| 11 — Isolation Valves |
| 12 — Flex Connections |
| 13 — Pressure Reducing/Fill Valve |
| 14 — Air Separator and Vent |

Fig. 10 — Typical Piping Diagram on 30RA Units With Hydronic Package

AIR SEPARATION — For proper system operation, it is essential that water loops be installed with proper means to manage air in the system. Free air in the system can cause noise, reduce terminal output, stop flow, or even cause pump failure due to pump cavitation. For closed systems, equipment should be provided to eliminate all air from the system.

The amount of air that water can hold in solution depends on the pressure and temperature of the water/air mixture. Air is less soluble at higher temperatures and at lower pressures. Therefore, separation can best be done at the point of highest water temperature and lowest pressure. Typically, this point would be on the suction side of the pump as the water is returning from the system or terminals. Generally speaking, this is the best place to install an air separator, if possible.

1. Install automatic air vents at all high points in the system. (If the 30RA unit is located at the high point of the system, a vent can be installed on the piping entering the heat exchanger on the 1/4-in. NPT female port.)
2. Install an air separator in the water loop, at the place where the water is at higher temperatures and lower pressures — usually in the chilled water return piping. On a primary-secondary system, the highest temperature water is normally in the secondary loop, close to the decoupler. Preference should be given to that point on the system (see Fig. 12). In-line or centrifugal air separators are readily available in the field.

It may not be possible to install air separators at the place of lowest pressure and highest temperature. In such cases, preference should be given to the points of highest temperature. It is important that pipe be sized correctly so that free air can be moved to the point of separation. Generally, a water velocity of at least 2 feet per second will keep free air entrained and prevent it from forming air pockets.

Automatic vents should be installed at all physically elevated points in the system so that air can be eliminated during system operation. Provision should also be made for manual venting during the water loop fill. It is important that the automatic vents be located in accessible locations for maintenance purposes, and that they be located where they can be prevented from freezing.

WATER CONNECTIONS — The water connections are copper or brass FPT. Any connecting pipe to the 30RA pump package must be of a material that will not cause any galvanic corrosion. For this reason, galvanized steel pipe or other dissimilar metals must not be used unless joined by a dielectric coupling. The connection sizes for the 30RA unit sizes 010-030 are 2-in. FPT. Sizes 032-055 use 2 1/2-in. FPT.

Follow the steps below when connecting pipe to the unit water connections:

1. Remove side panel(s) of unit to access the piping area.
2. Remove access covers of pump box.
3. Use a backup wrench on internal water connections to prevent twisting of internal piping, using a good sealant that will also allow for disconnecting the pipes if needed.
4. After connection is made, replace access covers of pump box and side panels of unit.

WATER SYSTEM CLEANING — Proper water system cleaning is of vital importance. Excessive particulates in the water system can cause excessive pump seal wear, reduce or stop flow, and cause damage of other components. Water quality should be maintained within the limits indicated in Table 2.

1. Install a temporary bypass around the chiller to avoid circulating dirty water and particulates into the pump package and chiller during the flush. Use a temporary circulating pump during the cleaning process. Also, be sure that there is capability to fully drain the system after cleaning. (See Fig 13.)

2. Be sure to use a cleaning agent that is compatible with all system materials. Be especially careful if the system contains any galvanized or aluminum components. Both detergent-dispersant and alkaline-dispersant cleaning agents are available.
3. It is a good idea to fill the system through a water meter. This provides a reference point for the future for loop volume readings, but it also establishes the correct quantity of cleaner needed in order to get the required concentration.
4. Use a feeder/transfer pump to mix the solution and fill the system. Circulate the cleaning system for the length of time recommended by the cleaning agent manufacturer.
 - a. After cleaning, drain the cleaning fluid and flush the system with fresh water.
 - b. A slight amount of cleaning residue in the system can help keep the desired, slightly alkaline, water pH of 8 to 9. Avoid a pH greater than 10, since this will adversely affect pump seal components.
 - c. A side stream filter is recommended (see Fig. 14) during the cleaning process. Filter side flow rate should be enough to filter the entire water volume every 3 to 4 hours. Change filters as often as necessary during the cleaning process.
 - d. Remove temporary bypass when cleaning is complete.

A strainer with a blow-down valve is standard on all 30RA units, both with and without hydronic packages. The blow-down valve allows removal of particulates caught in the strainer without complete removal of the screen. A female NPT connection is provided on the valve, allowing hose connection for drainage outside the unit.

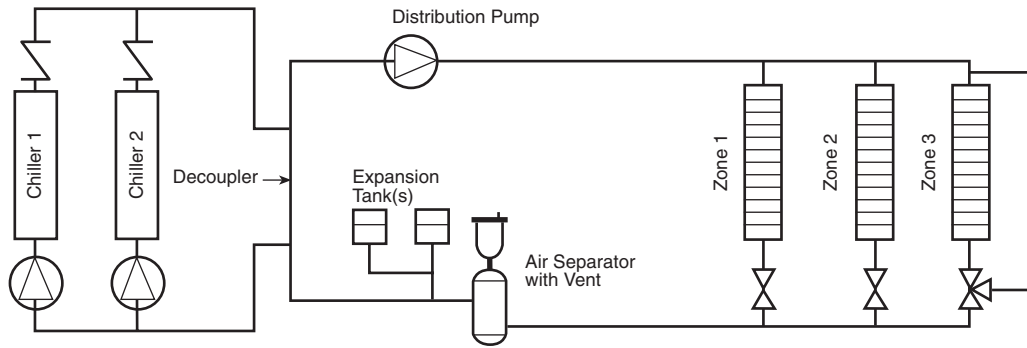
The Carrier *ComfortLink*TM controls provided have a built-in feature to remind building owners or operators to clean the strainer by discharging the blow-down valve at a pre-set time interval. Properly installed and cleaned systems will rarely need the strainer cleaned after the initial fill. This time interval is user-configurable.

Table 2 — Water Quality Characteristics and Limitations

| WATER CHARACTERISTIC | QUALITY LIMITATION |
|--|--------------------|
| Alkalinity (HCO ₃ ⁻) | 70 – 300 ppm |
| Sulfate (SO ₄ ²⁻) | Less than 70 ppm |
| HCO ₃ ⁻ /SO ₄ ²⁻ | Greater than 1.0 |
| Electrical Conductivity | 10 – 500 µS/cm |
| pH | 7.5 – 9.0 |
| Ammonium (NH ₃) | Less than 2 ppm |
| Chlorides (Cl ⁻) | Less than 300 ppm |
| Free chlorine (Cl ₂) | Less than 1 ppm |
| Hydrogen Sulfide (H ₂ S)* | Less than 0.05 ppm |
| Free (aggressive) Carbon Dioxide (CO ₂)† | Less than 5 ppm |
| Total Hardness (dH) | 4.0 – 8.5 |
| Nitrate (NO ₃) | Less than 100 ppm |
| Iron (Fe) | Less than 0.2 ppm |
| Aluminum (Al) | Less than 0.2 ppm |
| Manganese (Mn) | Less than 0.1 ppm |

*Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within the ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

†Dissolved carbon dioxide can either be calculated from the pH and total alkalinity values, shown below, or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x 2^[(6.3-pH)/0.3] where TA = Total Alkalinity, PPM as CaCO₃.



NOTE: Expansion tanks in the 30RA hydronic kits must be disconnected for chillers placed parallel in the primary water loop.

Fig. 12 — Typical Air Separator and Expansion Tank Location on Primary-Secondary Systems

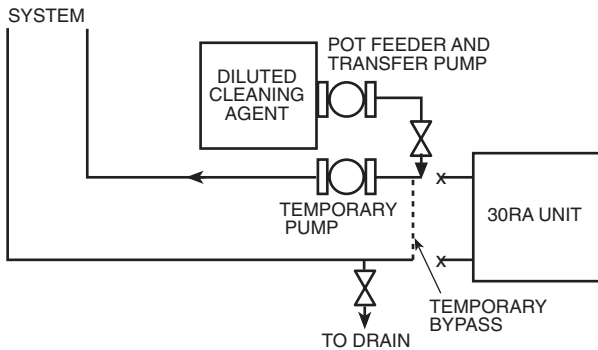


Fig. 13 — Typical Set Up for Cleaning Process

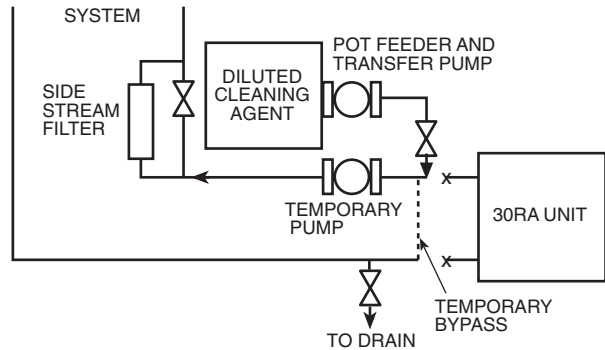


Fig. 14 — Cleaning Using a Side Stream Filter

SYSTEM PRESSURIZATION — A proper initial cold fill pressure must be established before the filling of the unit. The initial cold fill pressure is the pressure applied at the filling point to fill a system to its highest point, plus a minimum pressure at the top of the system (4 psi minimum) to operate air vents and positively pressurize the system.

The compression tank (sometimes called expansion tank) is very important to system pressurization. The compression tank actually serves several purposes:

1. Provide Net Positive Suction Head Required (NPSHR) for the pump to operate satisfactorily.
2. Set system pressure.
3. Accommodate expansion/contraction of water due to temperature changes.
4. Acts as a pressure reference for the pump.

The compression tank pressure must be set **BEFORE** the system is filled. The tanks are pre-charged at the factory to 40 psig. If the 30RA unit with expansion tank is the high point in the system, tank pre-charge pressure of 40 psig will be adequate. If the 30RA unit with expansion tank is **NOT** at the high point in the system, then the minimum pre-charge pressure for the water system must be determined using Table 3 and the method below:

$$\text{Tank Pressure} = 4 + (\text{height from tank to top of system in feet} \div "X")$$

For example, assuming a system containing a 20% concentration of ethylene glycol and 50 feet in height from the top of the system to the expansion tank, the minimum tank pre-charge pressure would be:

$$\text{Tank Pressure} = 4 + (50 \div 2.38) = 25.0 \text{ psig}$$

Table 3 — "X" Factor for Setting Tank Pressure

| % GLYCOL | ETHYLENE GLYCOL | PROPYLENE GLYCOL |
|----------------|-----------------|------------------|
| 0 (pure water) | 2.31 | 2.31 |
| 10 | 2.36 | 2.33 |
| 20 | 2.38 | 2.36 |
| 30 | 2.40 | 2.38 |
| 40 | 2.43 | 2.38 |
| 50 | 2.47 | 2.40 |

NOTE: If expansion tanks are placed elsewhere in the system this method cannot be used since extra pressure drop between the tank and the pump must be accounted for.

NOTE: If the system requires a pre-charge greater than 40 psig, increase pressure as described below.

Expansion Tank Pre-Charge — To pre-charge the expansion tank, do the following steps:

1. Check the tank air pressure at the pre-charge connection with an accurate pressure gage. Adjust as needed.
2. If additional pressure is required, charge the tank with oil-free compressed air or nitrogen gas. Occasionally check the pressure as when filling a tire.
3. Check the air valve for leakage. If it leaks, relieve the pressure and replace the core with a Schraeder type tire core. **DO NOT** depend on the valve cap to seal the leak.

Once the system is pressurized, the pressure at the connection point of the expansion tank to water piping will not change unless the water loop volume changes (either due to addition/subtraction of water or temperature expansion/contraction). The pressure at this point remains the same regardless of whether or not the pump is running.

Since the expansion tank acts as a reference point for the pump, there cannot be two reference points (two expansion tanks) in a system (unless manifolded together). If system volume or other design considerations warrant the placement of another expansion tank somewhere in the system, the expansion tank in the 30RA hydronic package **MUST** be disconnected from its hose and the end of the hose securely plugged.

This is also true for applications where two or more 30RA chillers are placed in parallel. There should not be more than one expansion tank in the system (unless manifolded together as seen in Fig. 12). The expansion tanks must be disconnected from the 30RA hydronic package. It is permissible to install the expansion tank(s) in a portion of the return water line that is common to all pumps, providing that the tank is properly sized for combined system volume.

If the application involves two or more chillers in a primary-secondary system, a common place for mounting the expansion tank is in the chilled water return line, just before the decoupler. See Fig. 12 for placement of expansion tank in primary-secondary systems.

The expansion tank included in the 30RA hydronic package is a diaphragm tank, meaning that a flexible diaphragm physically separates the water/air interface. With this type of expansion tank, it is undesirable to have any air in the water loop. See the section on air separation on page 13 for instructions on providing air separation equipment.

FILLING THE SYSTEM — The initial fill of the chilled water system must accomplish three purposes:

1. The entire piping system must be filled with water.
2. The pressure at the top of the system must be high enough to vent air from the system (usually 4 psig is adequate for most vents).
3. The pressure at all points in the system must be high enough to prevent flashing in the piping or cavitation in the pump.

The pressure created by an operating pump affects system pressure at all points except one — the connection of the compression tank to the system. This is the only location in the system where pump operation will not give erroneous pressure indications during the fill. Therefore, the best location to install the fill connection is close to the expansion tank. An air vent should be installed close by to help eliminate air that enters during the fill procedure.

Ensure the following when filling the system:

1. Remove temporary bypass piping and cleaning/flushing equipment.
2. Check to make sure all drain plugs are installed.

3. Open the blow-down valve to flush the strainer.

Normally, a closed system needs to be filled only once. The actual filling process is generally a fairly simple procedure. All air should be purged or vented from the system. Thorough venting at the high points and circulation at room temperature for several hours is recommended.

NOTE: Local codes concerning backflow devices and other protection of the city water system should be consulted and followed to prevent contamination of the public water supply. This is especially important when anti-freeze is used in the system.

Set Water Flow Rate — Once the system is cleaned, pressurized, and filled, the flow rate through the chiller needs to be established. On units with the hydronic package, this can best be done using the balancing valve.

In order to adjust the balancing valve, put a differential pressure gage across the pressure taps on the valve. Make sure that all system isolation and control valves are open. Use Tables 4 and 5 or a Bell & Gossett balancing valve calculator to determine GPM. To read Tables 4 and 5:

1. Measure the pressure drop across the balancing valve. If the pressure reading is in psi, multiply psi x 2.31 to convert to feet of water before using Tables 4 and 5.
2. Go to the row in the chart corresponding to the setting on the valve, interpolating if necessary.
3. The GPM corresponding to the pressure drop measured is the flow through the balancing valve.

NOTE: Carrier recommends a differential pressure gage when measuring pressures across the pumps or balancing valves. This provides for greater accuracy and reduces error build-up that often occurs when subtracting pressures made by different gages.

On primary/secondary systems, it is advisable to set the 30RA balancing valve to maintain design flow plus 10% through the chiller.

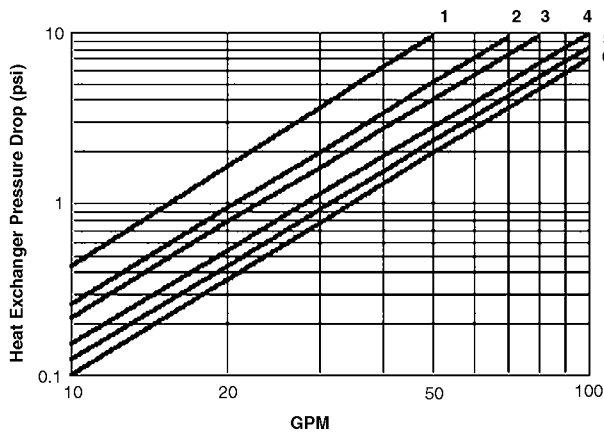
A rough estimate of water flow can also be obtained from the pressure gages across the 30RA heat exchanger. Figures 15A-16B show the relationship between GPM and heat exchanger pressure drop. It should be noted that these curves are for “clean” heat exchangers; they do not apply to heat exchangers with fouling. To read the chart, subtract the readings of the two pressure gages on the hydronic kit. This number is the pressure drop across the heat exchanger. Adjust the factory-installed balancing valve or external balancing valve (units without hydronic package) until the correct pressure drop is obtained for the required GPM.

Table 4 — Head (Ft Water) as Read on Balancing Valve for 30RA010-030

| SETTING | GPM | | | | | | | | | | | | | | | | | | | | |
|---------|-----|-----|------|-----|-----|------|------|-----|------|------|------|-----|------|------|------|------|------|------|------|----|------|
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| 0 | 0 | 0 | 0.1 | 0.3 | 0.6 | 0.9 | 1.3 | 1.8 | 2.3 | 2.9 | 3.6 | 4.4 | 5.2 | 6.1 | 7.1 | 8.1 | 9.2 | 10.4 | 11.7 | 13 | 14.4 |
| 10 | 0 | 0.1 | 0.3 | 0.7 | 1.2 | 1.8 | 2.7 | 3.6 | 4.7 | 6 | 7.4 | 8.9 | 10.6 | 12.4 | 14.4 | 16.6 | 18.9 | | | | |
| 20 | 0 | 0.2 | 0.7 | 1.6 | 2.9 | 4.6 | 6.6 | 8.9 | 11.7 | 14.8 | 18.2 | | | | | | | | | | |
| 30 | 0 | 0.5 | 2 | 4.6 | 8.1 | 12.7 | 18.3 | | | | | | | | | | | | | | |
| 40 | 0 | 1.6 | 6.2 | 14 | | | | | | | | | | | | | | | | | |
| 50 | 0 | 4.1 | 16.2 | | | | | | | | | | | | | | | | | | |

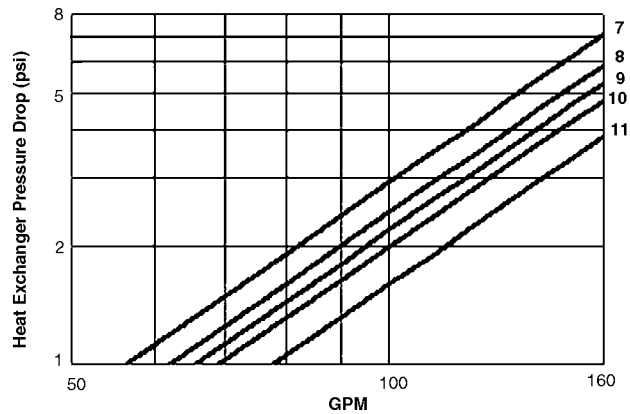
Table 5 — Head (Ft Water) as Read on Balancing Valve for 30RA032-055

| SETTING | GPM | | | | | | | | | | | | | | | | |
|---------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|
| | 40 | 50 | 60 | 70 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 |
| 0 | 0.9 | 1.4 | 2 | 2.7 | 3.5 | 4 | 4.4 | 4.9 | 5.5 | 6 | 6.6 | 7.2 | 7.9 | 8.5 | 9.2 | 10 | 10.7 |
| 10 | 1.6 | 2.5 | 3.6 | 5 | 6.5 | 7.3 | 8.2 | 9.1 | 10.1 | 11.2 | 12.3 | 13.4 | 14.6 | 15.8 | 17.1 | 18.5 | 19.9 |
| 20 | 3.4 | 5.3 | 7.6 | 10.4 | 13.6 | 15.3 | 17.2 | 19.1 | 21.2 | 23.4 | 25.7 | 28.1 | 30.5 | 33.1 | 35.8 | 38.7 | 41.6 |
| 30 | 8.5 | 13.3 | 19.2 | 26.2 | 34.2 | 38.6 | 43.2 | 48.2 | 53.4 | 58.9 | 64.6 | 70.6 | 76.9 | 83.4 | 90.2 | 97.3 | 104.7 |
| 40 | 23.7 | 37 | 53.2 | 72.4 | 94.6 | 106.8 | 119.8 | 133.4 | 147.8 | 163 | 178.9 | 195.5 | 212.9 | 231 | 249.8 | 269.4 | 289.8 |
| 50 | 54.6 | 85.3 | 122.8 | 167.2 | 218.3 | 246.5 | 276.3 | 307.9 | 341.1 | 376.1 | 412.8 | 451.1 | 491.2 | 533 | 576.5 | 621.7 | 668.6 |



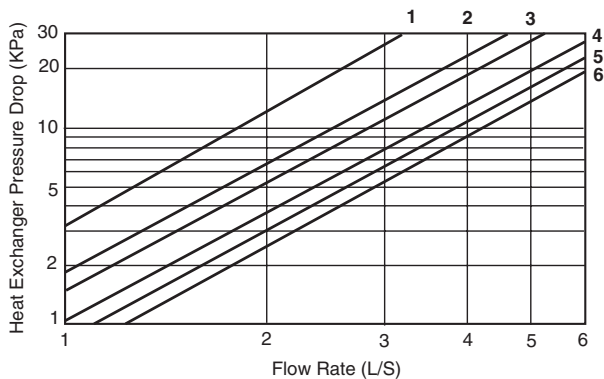
LEGEND
 1 — 30RA010 4 — 30RA022
 2 — 30RA015 5 — 30RA025
 3 — 30RA018 6 — 30RA030

Fig. 15A — Heat Exchanger Pressure Drop — 30RA010-030 (English)



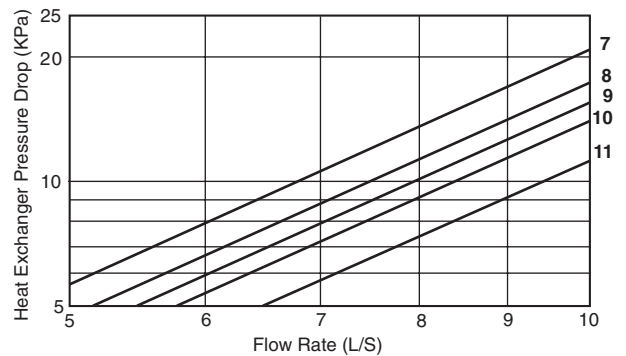
LEGEND
 7 — 30RA032, 30RA035 10 — 30RA050
 8 — 30RA040 11 — 30RA055
 9 — 30RA042, 30RA045

Fig. 16A — Heat Exchanger Pressure Drop — 30RA032-055 (English)



LEGEND
 1 — 30RA010 4 — 30RA022
 2 — 30RA015 5 — 30RA025
 3 — 30RA018 6 — 30RA030

Fig. 15B — Heat Exchanger Pressure Drop — 30RA010-030 (SI)



LEGEND
 7 — 30RA032, 30RA035 10 — 30RA050
 8 — 30RA040 11 — 30RA055
 9 — 30RA042, 30RA045

Fig. 16B — Heat Exchanger Pressure Drop — 30RA032-055 (SI)

Minimum Loop Volume — The preferred minimum loop volume is equal to twice the water flow rate per ton. (For example, the preferred water volume for 2.4 GPM/ton would be $2 \times 2.4 = 4.8$ gallons in the loop per ton of cooling.) In order to obtain leaving water temperature stability for comfort cooling applications, a minimum of 3 gallons per ton is required on all other unit sizes. For process cooling applications, where high stability is critical, the loop volume should be increased to 6 to 10 gallons per ton of cooling.

In order to achieve this volume, it may be necessary to add a water storage tank to the water loop. (The compression/expansion tank on the 30RA hydronic package is NOT a storage tank. If a storage tank is added to the system, it should be properly vented so that the tank can be completely filled and all air eliminated. Failure to do so could cause lack of pump stability and poor system operation.)

NOTE: On systems with a high volume, check the section on maximum loop volume. A different expansion tank may be required on systems with very high loop volumes.

Any storage tank that is placed in the water loop should have internal baffles to allow thorough mixing of the fluid. See Fig 17.

A properly baffled storage tank is available from the factory as an accessory. These tanks are designed to physically fit beneath the corresponding 30RA unit, taking up the same footprint.

Available volumes are as follows:

- 30RA010-018 110 gallons
- 30RA022-030 152 gallons
- 30RA032-055 305 gallons

Maximum Loop Volume — Since the minimum size of the expansion tank is dependent upon loop volume, units with the integrated hydronic kit must not exceed the maximum loop volume limits below (see Table 6). The limits are dependent on the maximum and minimum temperatures of the water, the maximum and minimum pressures seen by the expansion tank, and the heat transfer fluid. Expansion tank and maximum loop volume data is as follows.

| | 30RA010-030 | 30RA032-055 |
|-----------------------|-------------|-------------|
| Volume gal | 4.4 | 10.3 |
| Acceptance Volume gal | 3.2 | 10.3 |

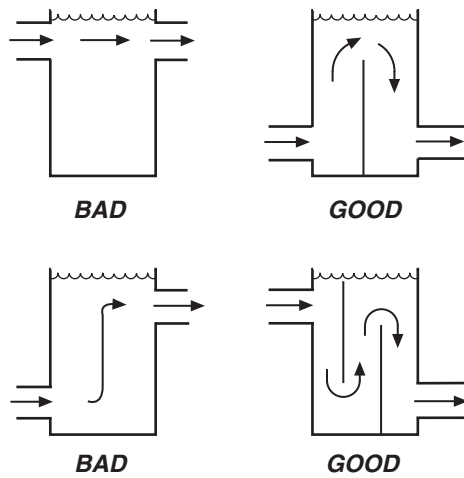


Fig. 17 — Tank Baffling

Table 6 — Maximum Loop Volume Limits

| MAX LOOP VOLUME IN GALLONS (LITERS) | | |
|-------------------------------------|-------------|-------------|
| % Ethylene Glycol | 30RA010-030 | 30RA032-055 |
| 0 (Pure Water) | 310 (1173) | 725 (2744) |
| 10 | 180 (681) | 425 (1609) |
| 20 | 175 (662) | 410 (1552) |
| 30 | 155 (587) | 370 (1400) |
| 40 | 150 (568) | 350 (1325) |
| 50 | 145 (549) | 340 (1287) |
| % Propylene Glycol | 30RA010-030 | 30RA032-055 |
| 10 | 175 (662) | 410 (1552) |
| 20 | 150 (568) | 350 (1325) |
| 30 | 128 (484) | 300 (1136) |
| 40 | 118 (447) | 275 (1041) |

NOTE: Max loop volume is based on typical system of 12 psi and 30 psi of min/max pressures, and 100 F mean temperature. If the volume in the system is greater than the limits listed, then extra expansion tank volume must be added to the system.

Pump Modification/Trimming — Since the pumps are constant speed, the only way to obtain greater flow with a given pump/impeller is to decrease system head. This will allow the pump to “ride” its curve to the right, resulting in increased flow. If greater flow is necessary, look at opening the balance valve. Also, verify that the strainer is clean, and that no unnecessary system resistance is present, such as partially closed isolation valves.

Increasing system resistance by closing the balancing valve will force the pump to “ride” its curve to the left, resulting in less flow. Although this does reduce power consumption slightly, it may not be the desirable method of reducing the flow, especially if a rather large reduction is needed.

The other method for reducing flow on a constant speed pump is impeller trimming. The impellers in the pumps provided in the 30RA hydronic kit are easily removable for this purpose. Refer to the ITT literature packet supplied with the hydronic package information on Seal Replacement in the Service Section, and follow its instructions for impeller removal. Trimming should only be done by a qualified machine shop

that has experience in this operation. Contact your local Carrier representative for a recommended machine shop. After trimming, the impeller **MUST** be balanced. Failure to balance trimmed impellers can result in excessive vibration, noise, and premature bearing failure.

Impeller trimming has the added benefit of maximum BHP savings. It is very possible for power savings to pay for the trimming cost very quickly.

Freeze Protection — The 30RA units are provided with a water strainer and a flow switch to protect against freezing situations that occur from no water flow. While the flow switch (paddle-type) is helpful in preventing freezing during no-flow situations, it does not protect the chiller in case of power failure, or in other cases where water temperature falls below the freezing mark. Appropriate concentrations of inhibited ethylene glycol or other suitable inhibited antifreeze solution should be considered for chiller protection where ambient temperatures are expected to fall below 32 F. Consult local water treatment specialist on characteristics of the system water and add a recommended inhibitor to the chilled water.

1. If the pump will be subjected to freezing temperatures, steps must be taken to prevent freeze damage. If the pump will not be used during this time, it is recommended to drain the pump and hydronic package and these components back-flushed with inhibited glycol. Otherwise, a glycol-water solution should be considered as the heat transfer fluid. Drains are located on the balancing valves for units with hydronic kits. Units without hydronic kits have a drain mounted on the piping leaving the heat exchanger. Drain knockouts are located on the sheet metal base of all units.

NOTE: Do not use automobile anti-freeze, or any other fluid that is not approved for heat exchanger duty. Only use appropriately inhibited glycols, concentrated to provide adequate protection for the temperature considered.

2. Use an electric tape heater for the internal piping (excluding those within the pump box) if unit will be exposed to freezing temperature.
3. Ensure that power is available to the chiller at all times, even during the off-season, so that the pump and cooler heaters have power. Also make sure that the piping tape heaters also have power.
4. On units with pump packages, a heater is supplied in the pump box that will protect this section from freezing in outdoor-air temperatures down to -20 F, except in case of a power failure. Carrier warranty does not cover damage due to freezing.
5. Cooler heaters that will protect down to -20 F can be installed as a factory option. Again, it should be noted that these heaters will not protect the cooler from freezing in the event of a power failure.

Preparation for Winter Shutdown — Do not shut off power disconnect during off-season shutdown. At the end of the cooling season:

1. Drain water from system.
2. Replace drain plug(s) and add sufficient inhibited ethylene glycol (or other suitable inhibited antifreeze) to cooler, pump and piping to prevent freezing of residual water.
3. At the beginning of the next cooling season, refill cooler and add recommended inhibitor.

Step 5 — Make Electrical Connections



ELECTRIC SHOCK HAZARD.

To avoid the possibility of electrical shock, open and tag all disconnects before installing this equipment.

POWER SUPPLY — Electrical characteristics of available power supply must agree with unit nameplate rating. Field wiring size and supply voltage must be within limits shown in Tables 7 and 8. See Tables 9-11 for component electrical data.

IMPORTANT: Operating unit on improper supply voltage or with excessive phase imbalance constitutes abuse and may affect Carrier warranty.

POWER WIRING — All power wiring must comply with applicable local and national codes. Install field-supplied branch circuit fused disconnect per NEC (National Electric Code, U.S.A.) of a type can be locked OFF or ON. Disconnect must be within sight from and readily accessible from unit in compliance with NEC Article 440-14.

General Wiring Notes

1. The control circuit does NOT require a separate power source. Control circuit power is obtained by a step-down transformer from the main three-phase power supply. Up to two terminal blocks are provided for field-wired control devices.
2. Cooler and pump heaters (if factory installed) are wired in the control circuit so they are operable as long as the main power supply to the unit is ON. A factory-installed and set overload device protects them.

NOTE: The field-supplied disconnect should never be off except when unit is being serviced or is to be down for a prolonged period, in which case cooler should be drained.

3. Power entry is at one end only.
4. Maximum field wire sizes allowed by lugs on terminal block/non-fused disconnect are listed in Table 7.
5. Terminals for field power supply are suitable for copper conductors. Insulation must be rated 167 F (75 C) minimum.

Table 7 — Recommended Field Wiring Sizes

| CONNECTION TYPE | MAX WIRE SIZE | UNIT SIZE AND VOLTAGE |
|---------------------------------|---------------|--|
| TERMINAL BLOCK | #2/0 AWG | 30RA010-030 (all voltages) |
| | 350 kcmil | 30RA035-055 (all voltages) |
| 60/100 AMP NON-FUSED DISCONNECT | #1 AWG | 30RA010-055 (575-3-60) |
| | | 30RA010-030 (380-3-60, 460-3-60) |
| | | 30RA010-025 (380/415-3-50) |
| | | 30RA010-018 (230-3-50, 230-3-60, 208/230-3-60) |
| 250 AMP NON-FUSED DISCONNECT | 350 kcmil | 30RA035-055 (380-3-60, 460-3-60) |
| | | 30RA032-045 (380/415-3-50) |
| | | 30RA022-045 (230-3-50) |
| | | 30RA022-055 (230-3-60, 208/230-3-60) |

AWG — American Wire Gage

FIELD CONNECTIONS

Main Power — Bring wires from the fused disconnect switch through hole in bottom of left front corner post (010-030 sizes) or through hole in bottom center panel (032-055 sizes) of unit to bottom of control box and connect to terminals on terminal

block or non-fused disconnect. A field neutral is required for 380/415-3-50 units only. To comply with NEC Article 440-14, the disconnect must be located within sight from and readily accessible from unit. Refer to Fig. 18 and 19.

IMPORTANT: To ensure power to the heaters, make sure auxiliary power to unit is always on (except for servicing or prolonged shutdown).

CAUTION

Proper rotation of condenser fan(s) MUST be verified before pumps or compressors are started. Consult the Controls, Start-Up and Operation manual provided with this chiller for correct procedure. Improper pump rotation can cause permanent damage to pump impeller and housing. If pump(s) have been removed for trimming, verify that wiring is reconnected in the original manner.

Control Power — Control power is obtained from the main power supply and does NOT require a separate source. A toggle switch (marked Emergency On-Off on the unit label diagram and by the switch) allows the control circuit to be manually disconnected when necessary. Cooler and pump heaters (if installed) are in an operable state when this switch is in the Off position.

Step 6 — Install Accessories

ELECTRICAL — A number of electrical accessories are available to provide the following optional features (for details, refer to the Controls, Start-Up, Operation, Service, and Troubleshooting book):

Energy Management Module (Used for any of the following types of temperature reset, demand limit and ice features):

- 4 to 20 mA leaving fluid temperature reset (requires field-supplied 4 to 20 mA generator)
- 4 to 20 mA cooling set point reset (requires field-supplied 4 to 20 mA generator)
- Discrete inputs for 2-step demand limit (requires field-supplied dry contacts)
- 4 to 20 mA demand limit (requires field-supplied 4 to 20 mA generator)
- Discrete input for Ice Done switch (requires field-supplied dry contacts)

Navigator Display — Provides hand-held, mobile capability using easy to read 4-line display. Keypad function is the same as the Scrolling Marquee module. Features magnet for 'hands free' service of components.

Low Ambient Operation — If outdoor ambient operating temperatures below 45 F (7.2 C) for 30RA010-018 units and 32 F (0.0° C) for 30RA022-055 units are expected, refer to separate installation instructions for low-ambient operation using accessory Motormaster® V control.

Minimum Load Accessory — If minimum load accessory is required, refer to unit Price Pages or contact your local Carrier representative for more details. For installation details, refer to separate installation instructions supplied with the accessory package.

Miscellaneous Accessories — For applications requiring special accessories, the following packages are available: Coil hail guard, external vibration, enhanced display, temperature reset, condenser coil grilles, storage tank and remote cooler. For installation details, refer to separate installation instructions supplied with these accessory packages.

Table 8 — Electrical Data

| UNIT 30RA | UNIT VOLTAGE | | | POWER SUPPLY QTY. REQD. | NO HYDRONIC PACKAGE | | | | 1.5/1.0 HP PUMP Pump Options 'A' or 'F' | | | 2.0/1.5 HP (STD) PUMP Pump Options 'B' or 'G' | | | 2.0/1.5 HP (ALT) PUMP Pump Options 'C' or 'H' | | | 3.0/2.0 HP PUMP Pump Options 'D' or 'J' | | | 5.0/3.0 HP PUMP Pump Options 'E' or 'K' | | |
|--------------|----------------|----------|-----|----------------------------------|---------------------|-------|-------|---------------------|---|------|---------------------|--|------|---------------------|--|------|---------------------|---|------|---------------------|---|------|---------------------|
| | V-Hz (3 Ph) | Supplied | | | MCA | MOCP | ICF | Rec Fuse Size | MCA | MOCP | Rec Fuse Size | MCA | MOCP | Rec Fuse Size | MCA | MOCP | Rec Fuse Size | MCA | MOCP | Rec Fuse Size | MCA | MOCP | Rec Fuse Size |
| | | Min | Max | | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL | XL |
| 010 | 230-60 | 207 | 253 | 1 | 46.2 | 70 | 272.6 | 60 | 50.2 | 80 | 60 | 51.4 | 80 | 60 | 51.4 | 80 | 60 | 53.6 | 80 | 70 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 51.3 | 80 | 273.4 | 60 | 55.7 | 90 | 70 | 57.0 | 90 | 70 | 57.0 | 90 | 70 | 59.5 | 90 | 70 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 23.8 | 35 | 123.8 | 30 | 25.8 | 40 | 30 | 26.4 | 40 | 35 | 26.4 | 40 | 35 | 27.5 | 40 | 35 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 19.2 | 30 | 83.0 | 25 | 20.8 | 30 | 25 | 21.2 | 30 | 25 | 21.2 | 30 | 25 | 22.1 | 35 | 30 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 29.9 | 50 | 159.6 | 35 | 32.3 | 50 | 40 | 33.0 | 50 | 40 | 33.0 | 50 | 40 | 34.3 | 50 | 40 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 28.5 | 45 | 138.8 | 35 | 30.2 | 50 | 40 | 31.0 | 50 | 40 | 31.0 | 50 | 40 | 31.6 | 50 | 40 | — | — | — |
| 230-50 | 207 | 253 | 1 | 48.9 | 80 | 231.3 | 60 | 51.7 | 80 | 70 | 52.9 | 80 | 70 | 52.9 | 80 | 70 | 54.0 | 80 | 70 | — | — | — | |
| 015 | 230-60 | 207 | 253 | 1 | 62.4 | 100 | 387.6 | 80 | 66.4 | 110 | 80 | 67.6 | 110 | 80 | 67.6 | 110 | 80 | 69.8 | 110 | 90 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 69.3 | 110 | 388.4 | 90 | 73.7 | 110 | 90 | 75.0 | 110 | 90 | 75.0 | 110 | 90 | 77.5 | 125 | 90 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 33.6 | 50 | 178.8 | 40 | 35.6 | 50 | 45 | 36.2 | 50 | 45 | 36.2 | 50 | 45 | 37.3 | 60 | 45 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 26.7 | 45 | 143.0 | 35 | 28.3 | 45 | 35 | 28.7 | 45 | 35 | 28.7 | 45 | 35 | 29.6 | 45 | 35 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 42.2 | 70 | 239.6 | 50 | 44.6 | 70 | 60 | 45.4 | 70 | 50 | 45.4 | 70 | 50 | 46.7 | 70 | 60 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 36.0 | 50 | 148.1 | 40 | 37.6 | 50 | 45 | 38.4 | 50 | 45 | 38.4 | 50 | 45 | 39.1 | 50 | 45 | — | — | — |
| 230-50 | 207 | 253 | 1 | 64.5 | 90 | 242.2 | 80 | 67.3 | 90 | 80 | 68.5 | 90 | 80 | 68.5 | 90 | 80 | 69.7 | 90 | 80 | — | — | — | |
| 018 | 230-60 | 207 | 253 | 1 | 67.3 | 90 | 271.2 | 80 | 71.3 | 90 | 80 | 72.5 | 90 | 80 | 72.5 | 90 | 80 | 74.7 | 100 | 90 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 74.8 | 100 | 274.9 | 90 | 79.2 | 100 | 90 | 80.5 | 110 | 90 | 80.5 | 110 | 90 | 83.0 | 110 | 100 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 35.5 | 45 | 147.9 | 40 | 37.5 | 50 | 45 | 38.1 | 50 | 45 | 38.1 | 50 | 45 | 39.2 | 50 | 45 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 28.5 | 35 | 99.3 | 35 | 30.1 | 40 | 35 | 30.5 | 40 | 35 | 30.5 | 40 | 35 | 31.4 | 40 | 35 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 44.0 | 60 | 182.1 | 50 | 46.4 | 60 | 60 | 47.1 | 60 | 60 | 47.1 | 60 | 60 | 48.5 | 60 | 60 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 38.9 | 50 | 139.4 | 45 | 40.6 | 50 | 45 | 41.3 | 50 | 50 | 41.3 | 50 | 50 | 42.0 | 50 | 50 | — | — | — |
| 230-50 | 207 | 253 | 1 | 69.5 | 90 | 239.4 | 80 | 72.3 | 100 | 80 | 73.5 | 100 | 90 | 73.5 | 100 | 90 | 74.6 | 100 | 90 | — | — | — | |
| 022 | 230-60 | 207 | 253 | 1 | 84.9 | 110 | 311.3 | 100 | 88.9 | 125 | 100 | 90.1 | 125 | 100 | 90.1 | 125 | 100 | 92.3 | 125 | 110 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 94.3 | 125 | 316.4 | 110 | 98.7 | 125 | 110 | 100.1 | 125 | 125 | 100.1 | 125 | 125 | 102.5 | 125 | 125 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 44.7 | 60 | 154.4 | 50 | 46.7 | 60 | 60 | 47.3 | 60 | 60 | 47.3 | 60 | 60 | 48.4 | 60 | 60 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 36.8 | 50 | 136.0 | 45 | 38.4 | 50 | 45 | 38.9 | 50 | 45 | 38.9 | 50 | 45 | 39.8 | 50 | 45 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 57.7 | 80 | 194.7 | 70 | 60.1 | 80 | 70 | 60.9 | 80 | 70 | 60.9 | 80 | 70 | 62.2 | 80 | 70 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 49.2 | 60 | 159.4 | 60 | 50.9 | 70 | 60 | 51.6 | 70 | 60 | 51.6 | 70 | 60 | 52.3 | 70 | 60 | — | — | — |
| 230-50 | 207 | 253 | 1 | 84.4 | 110 | 266.8 | 100 | 87.2 | 110 | 100 | 88.4 | 110 | 100 | 88.4 | 110 | 100 | 89.5 | 110 | 100 | — | — | — | |
| 025 | 230-60 | 207 | 253 | 1 | 92.2 | 125 | 311.3 | 110 | 96.2 | 125 | 110 | 97.4 | 125 | 110 | 97.4 | 125 | 110 | 99.6 | 125 | 110 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 102.4 | 125 | 316.4 | 125 | 106.8 | 125 | 125 | 108.2 | 125 | 125 | 108.2 | 125 | 125 | 110.6 | 150 | 125 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 50.3 | 70 | 160.0 | 60 | 52.3 | 70 | 80 | 52.9 | 70 | 80 | 52.9 | 70 | 80 | 54.0 | 70 | 80 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 41.2 | 50 | 140.4 | 50 | 42.8 | 50 | 50 | 43.3 | 50 | 50 | 43.3 | 50 | 50 | 44.2 | 60 | 50 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 65.2 | 90 | 202.2 | 80 | 67.6 | 90 | 80 | 68.4 | 90 | 80 | 68.5 | 90 | 80 | 69.7 | 90 | 80 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 59.1 | 80 | 203.8 | 70 | 60.8 | 80 | 70 | 61.5 | 80 | 70 | 61.5 | 80 | 70 | 62.2 | 80 | 70 | — | — | — |
| 230-50 | 207 | 253 | 1 | 101.3 | 125 | 359.3 | 125 | 104.0 | 125 | 125 | 105.3 | 125 | 125 | 105.3 | 125 | 125 | 106.4 | 125 | 125 | — | — | — | |
| 030 | 230-60 | 207 | 253 | 1 | 108.2 | 150 | 433.4 | 125 | 112.2 | 150 | 125 | 113.4 | 150 | 125 | 113.4 | 150 | 125 | 115.6 | 150 | 150 | — | — | — |
| | 208/230-60 | 187 | 253 | 1 | 120.2 | 150 | 439.3 | 150 | 124.6 | 150 | 150 | 125.9 | 150 | 150 | 125.9 | 150 | 150 | 128.4 | 175 | 150 | — | — | — |
| | 460-60 | 414 | 506 | 1 | 58.4 | 80 | 203.6 | 70 | 60.4 | 80 | 70 | 61.0 | 80 | 70 | 61.0 | 80 | 70 | 62.1 | 80 | 70 | — | — | — |
| | 575-60 | 518 | 633 | 1 | 46.4 | 60 | 162.7 | 60 | 48.0 | 60 | 60 | 48.4 | 60 | 60 | 48.4 | 60 | 60 | 49.3 | 60 | 60 | — | — | — |
| | 380-60 | 342 | 418 | 1 | 73.5 | 100 | 270.9 | 90 | 76.0 | 100 | 90 | 76.7 | 100 | 90 | 76.7 | 100 | 90 | 78.0 | 100 | 90 | — | — | — |
| | 380/415-50 | 342 | 440 | 1 | 73.0 | 90 | 217.7 | 80 | — | — | — | 75.4 | 90 | 90 | — | — | — | 76.1 | 100 | 90 | 78.2 | 100 | 90 |
| 230-50 | 207 | 253 | 1 | 126.2 | 150 | 384.2 | 150 | — | — | — | 130.2 | 150 | 150 | — | — | — | 131.3 | 150 | 150 | 134.9 | 175 | 150 | |
| 035 | 230-60 | 207 | 253 | 1 | 138.1 | 175 | 463.4 | 150 | — | — | — | 143.3 | 175 | 175 | — | — | — | 145.5 | 175 | 175 | 150.7 | 175 | 175 |
| | 208/230-60 | 187 | 253 | 1 | 153.4 | 200 | 472.5 | 175 | — | — | — | 159.1 | 200 | 175 | — | — | — | 161.6 | 200 | 175 | 167.3 | 200 | 200 |
| | 460-60 | 414 | 506 | 1 | 73.2 | 90 | 218.4 | 80 | — | — | — | 75.8 | 90 | 90 | — | — | — | 76.9 | 100 | 90 | 79.5 | 100 | 90 |
| | 575-60 | 518 | 633 | 1 | 59.3 | 70 | 175.7 | 70 | — | — | — | 61.4 | 80 | 70 | — | — | — | 62.3 | 80 | 70 | 64.3 | 80 | 70 |
| | 380-60 | 342 | 418 | 1 | 93.3 | 110 | 290.7 | 110 | — | — | — | 96.5 | 125 | 110 | — | — | — | 97.8 | 125 | 110 | 101.0 | 125 | 110 |
| | 380/415-50 | 342 | 440 | 1 | 87.1 | 110 | 231.8 | 100 | — | — | — | 89.5 | 110 | 100 | — | — | — | 90.2 | 110 | 100 | 92.3 | 110 | 100 |
| 230-50 | 207 | 253 | 1 | 149.1 | 175 | 407.1 | 175 | — | — | — | 153.1 | 175 | 175 | — | — | — | 154.2 | 175 | 175 | 157.8 | 175 | 175 | |
| 040 | 230-60 | 207 | 253 | 1 | 145.4 | 175 | 470.6 | 175 | — | — | — | 150.6 | 175 | 175 | — | — | — | 152.8 | 175 | 175 | 158.0 | 200 | 175 |
| | 208/230-60 | 187 | 253 | 1 | 161.5 | 200 | 480.6 | 175 | — | — | — | 167.2 | 200 | 200 | — | — | — | 169.7 | 200 | 200 | 175.4 | 200 | 200 |
| | 460-60 | 414 | 506 | 1 | 78.8 | 100 | 224.0 | 90 | — | — | — | 81.4 | 100 | 90 | — | — | — | 82.5 | 100 | 90 | 85.1 | 100 | 90 |
| | 575-60 | 518 | 633 | 1 | 63.7 | 80 | 180.1 | 70 | — | — | — | 65.8 | 80 | 80 | — | — | — | 66.7 | 80 | 80 | 68.7 | 80 | 70 |
| | 380-60 | 342 | 418 | 1 | 100.8 | 125 | 298.2 | 110 | — | — | — | 104.0 | 125 | 125 | — | — | — | 105.3 | 125 | 125 | 108.5 | 125 | 110 |
| | 380/415-50 | 342 | 440 | 1 | 84.2 | 100 | 194.4 | 90 | — | — | — | 86.6 | 100 | 100 | — | — | — | 87.3 | 100 | 100 | 89.4 | 100 | 90 |
| 230-50 | 207 | | | | | | | | | | | | | | | | | | | | | | |

Table 9 — Fan Electrical Data

| UNIT 30RA | UNIT VOLTAGE V-Hz (3 Ph) | STANDARD CONDENSER FANS | | | |
|--------------|-----------------------------|-------------------------|---------------|-----------------------|---------------|
| | | Circuit A Quantity | FLA (each) | Circuit B Quantity | FLA (each) |
| 010 | 230-60 | 1 | 7.6 | — | — |
| | 208/230-60 | 1 | 8.4 | — | — |
| | 460-60 | 1 | 3.8 | — | — |
| | 575-60 | 1 | 3.0 | — | — |
| | 380-60 | 1 | 4.6 | — | — |
| | 380/415-50 | 1 | 3.8 | — | — |
| | 230-50 | 1 | 6.3 | — | — |
| 015 | 230-60 | 1 | 7.6 | — | — |
| | 208/230-60 | 1 | 8.4 | — | — |
| | 460-60 | 1 | 3.8 | — | — |
| | 575-60 | 1 | 3.0 | — | — |
| | 380-60 | 1 | 4.6 | — | — |
| | 380/415-50 | 1 | 3.8 | — | — |
| | 230-50 | 1 | 6.3 | — | — |
| 018 | 230-60 | 1 | 7.6 | — | — |
| | 208/230-60 | 1 | 8.4 | — | — |
| | 460-60 | 1 | 3.8 | — | — |
| | 575-60 | 1 | 3.0 | — | — |
| | 380-60 | 1 | 4.6 | — | — |
| | 380/415-50 | 1 | 3.8 | — | — |
| | 230-50 | 1 | 6.3 | — | — |
| 022 | 230-60 | 2 | 4.8 | — | — |
| | 208/230-60 | 2 | 5.3 | — | — |
| | 460-60 | 2 | 2.4 | — | — |
| | 575-60 | 2 | 1.9 | — | — |
| | 380-60 | 2 | 2.9 | — | — |
| | 380/415-50 | 2 | 2.3 | — | — |
| | 230-50 | 2 | 3.8 | — | — |
| 025 | 230-60 | 2 | 4.8 | — | — |
| | 208/230-60 | 2 | 5.3 | — | — |
| | 460-60 | 2 | 2.4 | — | — |
| | 575-60 | 2 | 1.9 | — | — |
| | 380-60 | 2 | 2.9 | — | — |
| | 380/415-50 | 2 | 2.3 | — | — |
| | 230-50 | 2 | 3.8 | — | — |
| 030 | 230-60 | 2 | 4.8 | — | — |
| | 208/230-60 | 2 | 5.3 | — | — |
| | 460-60 | 2 | 2.4 | — | — |
| | 575-60 | 2 | 1.9 | — | — |
| | 380-60 | 2 | 2.9 | — | — |
| 032 | 380/415-50 | 2 | 2.3 | 1 | 3.8 |
| | 230-50 | 2 | 3.8 | 1 | 6.3 |
| 035 | 230-60 | 2 | 4.8 | 1 | 7.6 |
| | 208/230-60 | 2 | 5.3 | 1 | 8.4 |
| | 460-60 | 2 | 2.4 | 1 | 3.8 |
| | 575-60 | 2 | 1.9 | 1 | 3.0 |
| | 380-60 | 2 | 2.9 | 1 | 4.6 |
| | 380/415-50 | 2 | 2.3 | 1 | 3.8 |
| | 230-50 | 2 | 3.8 | 1 | 6.3 |
| 040 | 230-60 | 2 | 4.8 | 1 | 7.6 |
| | 208/230-60 | 2 | 5.3 | 1 | 8.4 |
| | 460-60 | 2 | 2.4 | 1 | 3.8 |
| | 575-60 | 2 | 1.9 | 1 | 3.0 |
| | 380-60 | 2 | 2.9 | 1 | 4.6 |
| 042 | 380/415-50 | 2 | 2.3 | 2 | 2.3 |
| | 230-50 | 2 | 3.8 | 2 | 3.8 |
| 045 | 230-60 | 2 | 4.8 | 2 | 4.8 |
| | 208/230-60 | 2 | 5.3 | 2 | 5.3 |
| | 460-60 | 2 | 2.4 | 2 | 2.4 |
| | 575-60 | 2 | 1.9 | 2 | 1.9 |
| | 380-60 | 2 | 2.9 | 2 | 2.9 |
| | 380/415-50 | 2 | 2.3 | 2 | 2.3 |
| | 230-50 | 2 | 3.8 | 2 | 3.8 |
| 050 | 230-60 | 2 | 4.8 | 2 | 4.8 |
| | 208/230-60 | 2 | 5.3 | 2 | 5.3 |
| | 460-60 | 2 | 2.4 | 2 | 2.4 |
| | 575-60 | 2 | 1.9 | 2 | 1.9 |
| | 380-60 | 2 | 2.9 | 2 | 2.9 |
| 055 | 230-60 | 2 | 4.8 | 2 | 4.8 |
| | 208/230-60 | 2 | 5.3 | 2 | 5.3 |
| | 460-60 | 2 | 2.4 | 2 | 2.4 |
| | 575-60 | 2 | 1.9 | 2 | 1.9 |
| | 380-60 | 2 | 2.9 | 2 | 2.9 |

LEGEND
FLA — Full Load Amps

Table 10 — Pump Electrical Data

| PUMP OPTION | PUMP SIZE | PUMP RPM | UNIT VOLTAGE V-Hz (3 Ph) | FLA | LRA |
|------------------------|--------------|-------------|-----------------------------|--------|--------|
| | | | | (each) | (each) |
| 'A' or 'F' | 1.5 HP | 3500 | 230-60 | 4.0 | 32.0 |
| | | 3500 | 208/230-60 | 4.4 | 36.0 |
| | | 3500 | 460-60 | 2.0 | 16.0 |
| | | 3500 | 575-60 | 1.6 | 14.4 |
| | | 3500 | 380-60 | 2.4 | 21.8 |
| | 1.0 HP | 2925 | 380/415-50 | 1.7 | 16.0 |
| | | 2925 | 230-50 | 2.8 | 32.0 |
| 'B', 'C' 'G' or 'H' | 2.0 HP | 3490 | 230-60 | 5.2 | 42.0 |
| | | 3490 | 208/230-60 | 5.8 | 47.0 |
| | | 3490 | 460-60 | 2.6 | 21.0 |
| | | 3490 | 575-60 | 2.1 | 18.8 |
| | | 3490 | 380-60 | 3.1 | 28.4 |
| | 1.5 HP | 2910 | 380/415-50 | 2.4 | 21.5 |
| | | 2910 | 230-50 | 4.0 | 42.0 |
| 'D' or 'J' | 3.0 HP | 3480 | 230-60 | 7.4 | 53.0 |
| | | 3480 | 208/230-60 | 8.2 | 58.0 |
| | | 3480 | 460-60 | 3.7 | 26.5 |
| | | 3480 | 575-60 | 3.0 | 25.6 |
| | | 3480 | 380-60 | 4.5 | 38.7 |
| | 2.0 HP | 2900 | 380/415-50 | 3.1 | 29.0 |
| | | 2900 | 230-50 | 5.1 | 53.0 |
| 'E' or 'K' | 5.0 HP | 3450 | 230-60 | 12.6 | 126.0 |
| | | 3450 | 208/230-60 | 13.9 | 136.8 |
| | | 3450 | 460-60 | 6.3 | 63.0 |
| | | 3450 | 575-60 | 5.0 | 55.4 |
| | | 3450 | 380-60 | 7.6 | 83.9 |
| | 3.0 HP | 2850 | 380/415-50 | 5.3 | 68.0 |
| | | 2850 | 230-50 | 8.7 | 126.0 |

LEGEND
FLA — Full Load Amps
LRA — Locked Rotor Amps

Table 11 — Compressor Electrical Data

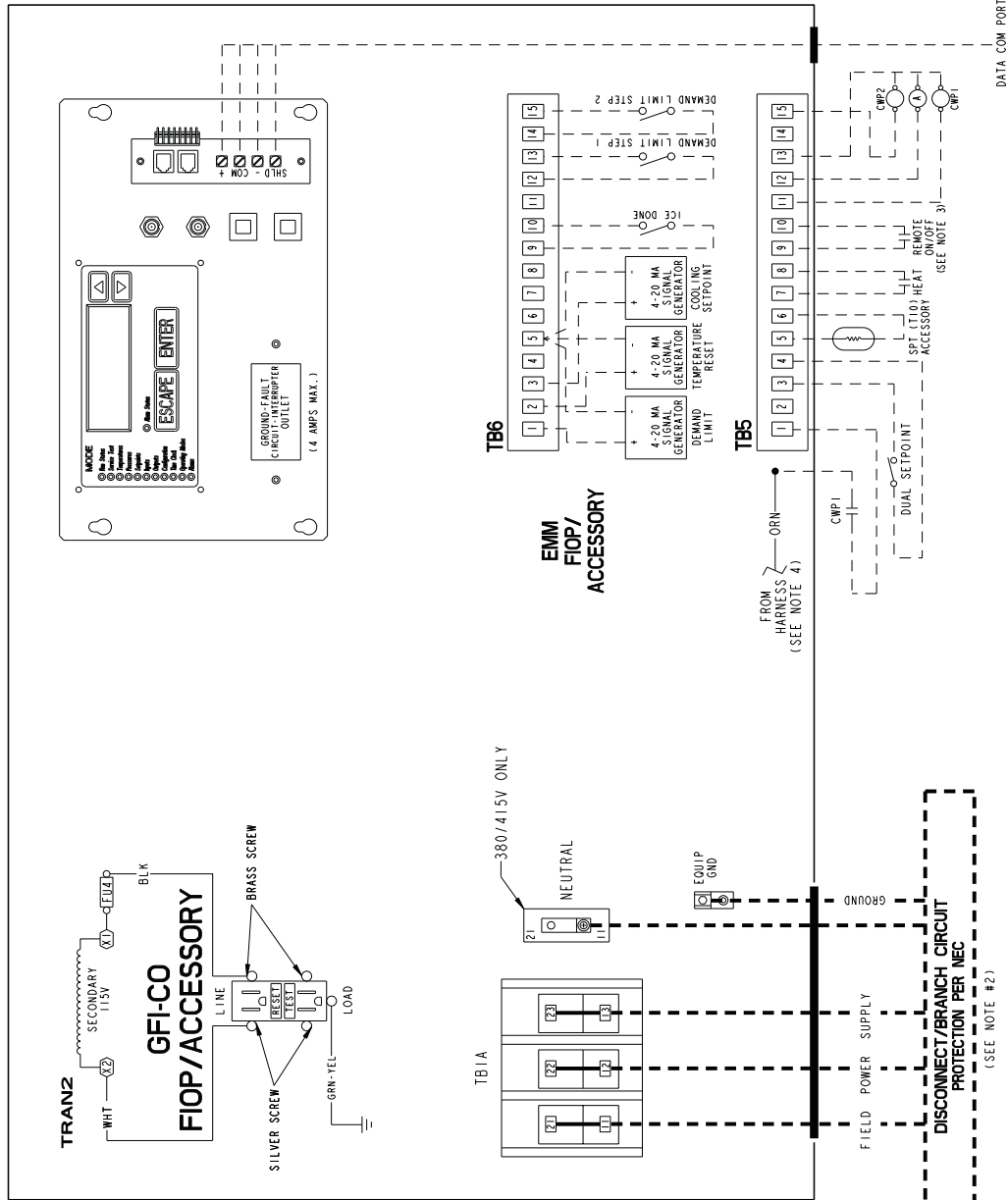
| UNIT 30RA | UNIT VOLTAGE V-Hz (3 Ph) | COMPRESSOR | | | | | | | |
|--------------|-----------------------------|------------|-----|------|-----|------|-----|------|-----|
| | | A1 | | A2 | | B1 | | B2 | |
| | | RLA | LRA | RLA | LRA | RLA | LRA | RLA | LRA |
| 010 | 230-60 | 30.9 | 265 | — | — | — | — | — | — |
| | 208/230-60 | 34.3 | 265 | — | — | — | — | — | — |
| | 460-60 | 16.0 | 120 | — | — | — | — | — | — |
| | 575-60 | 12.9 | 80 | — | — | — | — | — | — |
| | 380-60 | 20.2 | 155 | — | — | — | — | — | — |
| | 380/415-50 | 19.8 | 135 | — | — | — | — | — | — |
| | 230-50 | 34.1 | 225 | — | — | — | — | — | — |
| 015 | 230-60 | 43.8 | 380 | — | — | — | — | — | — |
| | 208/230-60 | 48.7 | 380 | — | — | — | — | — | — |
| | 460-60 | 23.8 | 175 | — | — | — | — | — | — |
| | 575-60 | 18.9 | 140 | — | — | — | — | — | — |
| | 380-60 | 30.1 | 235 | — | — | — | — | — | — |
| | 380/415-50 | 14.3 | 130 | 14.3 | 130 | — | — | — | — |
| | 230-50 | 25.9 | 210 | 25.9 | 210 | — | — | — | — |
| 018 | 230-60 | 26.6 | 237 | 26.6 | 237 | — | — | — | — |
| | 208/230-60 | 29.5 | 237 | 29.5 | 237 | — | — | — | — |
| | 460-60 | 14.1 | 130 | 14.1 | 130 | — | — | — | — |
| | 575-60 | 11.3 | 85 | 11.3 | 85 | — | — | — | — |
| | 380-60 | 17.5 | 160 | 17.5 | 160 | — | — | — | — |
| | 380/415-50 | 15.6 | 120 | 15.6 | 120 | — | — | — | — |
| | 230-50 | 28.1 | 205 | 28.1 | 205 | — | — | — | — |
| 022 | 230-60 | 29.4 | 265 | 36.7 | 265 | — | — | — | — |
| | 208/230-60 | 32.7 | 265 | 40.8 | 265 | — | — | — | — |
| | 460-60 | 14.6 | 120 | 20.2 | 135 | — | — | — | — |
| | 575-60 | 12.2 | 80 | 16.6 | 120 | — | — | — | — |
| | 380-60 | 18.9 | 155 | 26.4 | 170 | — | — | — | — |
| | 380/415-50 | 19.8 | 135 | 19.8 | 135 | — | — | — | — |
| | 230-50 | 34.1 | 225 | 34.1 | 225 | — | — | — | — |
| 025 | 230-60 | 36.7 | 265 | 36.7 | 265 | — | — | — | — |
| | 208/230-60 | 40.8 | 265 | 40.8 | 265 | — | — | — | — |
| | 460-60 | 20.2 | 135 | 20.2 | 135 | — | — | — | — |
| | 575-60 | 16.6 | 120 | 16.6 | 120 | — | — | — | — |
| | 380-60 | 26.4 | 170 | 26.4 | 170 | — | — | — | — |
| | 380/415-50 | 24.2 | 175 | 24.2 | 175 | — | — | — | — |
| | 230-50 | 41.6 | 310 | 41.6 | 310 | — | — | — | — |
| 030 | 230-60 | 43.8 | 380 | 43.8 | 380 | — | — | — | — |
| | 208/230-60 | 48.7 | 380 | 48.7 | 380 | — | — | — | — |
| | 460-60 | 23.8 | 175 | 23.8 | 175 | — | — | — | — |
| | 575-60 | 18.9 | 140 | 18.9 | 140 | — | — | — | — |
| | 380-60 | 30.1 | 235 | 30.1 | 235 | — | — | — | — |
| 032 | 380/415-50 | 14.5 | 120 | 19.8 | 135 | 24.2 | 175 | — | — |
| | 230-50 | 26.2 | 205 | 34.1 | 225 | 41.6 | 310 | — | — |
| 035 | 230-60 | 29.4 | 265 | 36.7 | 265 | 43.8 | 380 | — | — |
| | 208/230-60 | 32.7 | 265 | 40.8 | 265 | 48.7 | 380 | — | — |
| | 460-60 | 14.6 | 120 | 20.2 | 135 | 23.8 | 175 | — | — |
| | 575-60 | 12.2 | 80 | 16.6 | 120 | 18.9 | 140 | — | — |
| | 380-60 | 18.9 | 155 | 26.4 | 170 | 30.1 | 235 | — | — |
| | 380/415-50 | 24.2 | 175 | 24.2 | 175 | 24.2 | 175 | — | — |
| | 230-50 | 41.6 | 310 | 41.6 | 310 | 41.6 | 310 | — | — |
| 040 | 230-60 | 36.7 | 265 | 36.7 | 265 | 43.8 | 380 | — | — |
| | 208/230-60 | 40.8 | 265 | 40.8 | 265 | 48.7 | 380 | — | — |
| | 460-60 | 20.2 | 135 | 20.2 | 135 | 23.8 | 175 | — | — |
| | 575-60 | 16.6 | 120 | 16.6 | 120 | 18.9 | 140 | — | — |
| | 380-60 | 26.4 | 170 | 26.4 | 170 | 30.1 | 235 | — | — |
| 042 | 380/415-50 | 19.8 | 135 | 19.8 | 135 | 19.8 | 135 | 19.8 | 135 |
| | 230-50 | 34.1 | 225 | 34.1 | 225 | 34.1 | 225 | 34.1 | 225 |
| 045 | 230-60 | 30.9 | 265 | 36.7 | 265 | 30.9 | 265 | 36.7 | 265 |
| | 208/230-60 | 34.3 | 265 | 40.8 | 265 | 34.3 | 265 | 40.8 | 265 |
| | 460-60 | 16.0 | 120 | 20.2 | 135 | 16.0 | 120 | 20.2 | 135 |
| | 575-60 | 12.9 | 80 | 16.6 | 120 | 12.9 | 80 | 16.6 | 120 |
| | 380-60 | 20.2 | 155 | 26.4 | 170 | 20.2 | 155 | 26.4 | 170 |
| | 380/415-50 | 24.2 | 175 | 24.2 | 175 | 24.2 | 175 | 24.2 | 175 |
| | 230-50 | 41.6 | 310 | 41.6 | 310 | 41.6 | 310 | 41.6 | 310 |
| 050 | 230-60 | 36.7 | 265 | 36.7 | 265 | 36.7 | 265 | 36.7 | 265 |
| | 208/230-60 | 40.8 | 265 | 40.8 | 265 | 40.8 | 265 | 40.8 | 265 |
| | 460-60 | 20.2 | 135 | 20.2 | 135 | 20.2 | 135 | 20.2 | 135 |
| | 575-60 | 16.6 | 120 | 16.6 | 120 | 16.6 | 120 | 16.6 | 120 |
| | 380-60 | 26.4 | 170 | 26.4 | 170 | 26.4 | 170 | 26.4 | 170 |
| 055 | 230-60 | 43.8 | 380 | 43.8 | 380 | 43.8 | 380 | 43.8 | 380 |
| | 208/230-60 | 48.7 | 380 | 48.7 | 380 | 48.7 | 380 | 48.7 | 380 |
| | 460-60 | 23.8 | 175 | 23.8 | 175 | 23.8 | 175 | 23.8 | 175 |
| | 575-60 | 18.9 | 140 | 18.9 | 140 | 18.9 | 140 | 18.9 | 140 |
| | 380-60 | 30.1 | 235 | 30.1 | 235 | 30.1 | 235 | 30.1 | 235 |

LEGEND

LRA — Locked Rotor Amps
 RLA — Rated Load Amps

- LEGEND**
- A** Alarm
 - CWP** Chilled Water Pump
 - CWPI** Chilled Water Pump Interlock
 - EMM** Energy Management
 - SPT** Space Temperature
- TB** Terminal Block
 - Field Power Wiring
 - Field Control Wiring
 - - - Factory-Installed Wiring

- NOTES:**
- Factory wiring is in accordance with UL 1995 standards. Any field wiring modifications or additions must be in compliance with all applicable codes.
 - Wiring for main field supply must be rated 75 C minimum. Use copper for all units. Maximum incoming wire size for the terminal block is #20 AWG. Maximum incoming wire size for 60 and 100-amp non-fused disconnect is #1 AWG. Maximum incoming wire size for 250-amp non-fused disconnect is 350 kcmil.
 - Terminals 9 and 10 of TB5 are for field external connections for remote on-off. The contacts must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.
 - Terminals 1 and 2 of TB5 are connected to the factory-installed chilled water flow switch (CWFS). To add chilled water pump interlock contacts, remove the orange harness wire from TB5-1 and wire contacts in series as shown. The contacts must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.
 - Terminals 11 and 13 of TB5 are for control of Chilled Water Pump 1 (CWP1) starter. Terminals 13 and 15 of TB5 are for control of Chilled Water Pump 2 (CWP2) starter. The maximum load allowed for the chilled water pump relay is 5 va sealed, 10 va inrush at 24 v. Field power supply is not required.
 - Terminals 12 and 13 of TB5 are for an alarm relay. The maximum load allowed for the alarm relay is 5 va sealed, 10 va inrush at 24 v. Field power supply is not required.
 - Make appropriate connections to TB6 as shown for Energy Management Board options. The contacts for Demand Limit and Ice Done options must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.



DATA COM PORT

NON-FUSED DISCONNECT POWER

STANDARD POWER

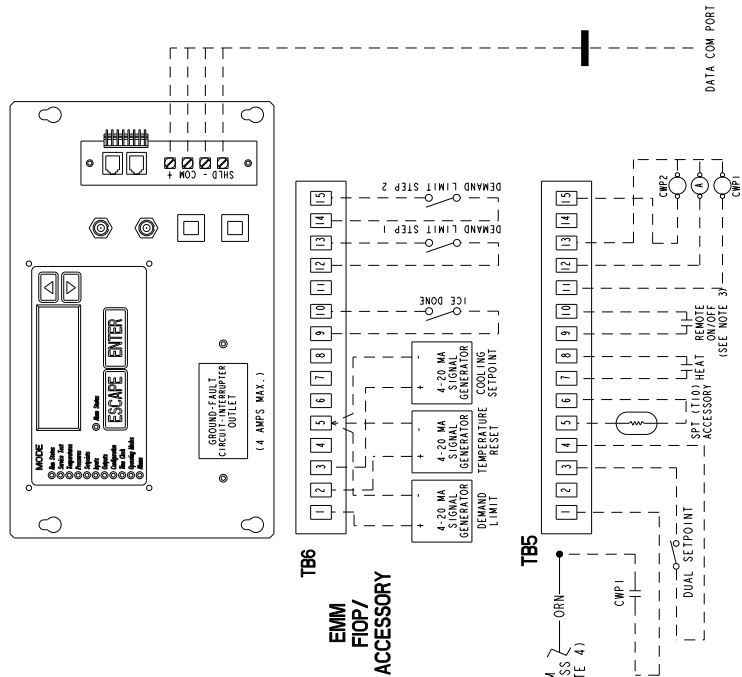
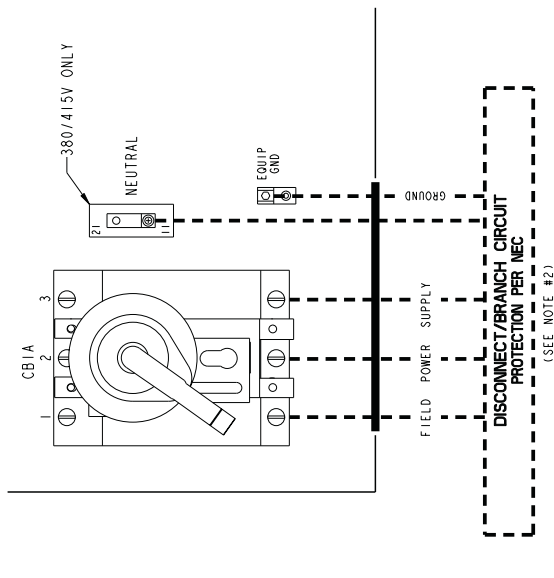
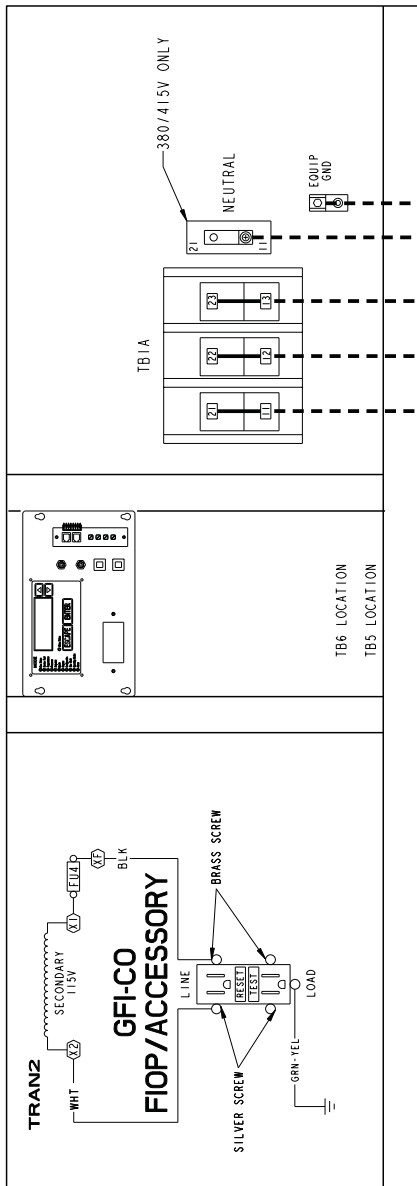
Fig. 18 — Main Power and Control Connections — 30RA010-030 Without Hydronic Package

LEGEND

- A** — Alarm
- CWP** — Chilled Water Pump
- CWPI** — Chilled Water Pump Interlock
- EMM** — Energy Management
- SPT** — Suction Pressure Transducer
- TB** — Terminal Block

- Field Power Wiring
- - - Field Control Wiring
- ==== Factory-Installed Wiring

- NOTES:**
1. Factory wiring is in accordance with UL 1995 standards. Any field wiring modifications or additions must be in compliance with all applicable codes.
 2. Wiring for main field supply must be rated 75 C minimum. Use copper for all units. Maximum incoming wire size for 100-amp non-fused disconnect is #1 AWG. Maximum incoming wire size for 250-amp non-fused disconnect is 350 kcmil.
 3. Terminals 9 and 10 of TB5 are for field external connections for remote on-off. The contacts must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.
 4. Terminals 1 and 2 of TB5 are connected to the factory-installed chilled water flow switch (CWPFS). To add chilled water pump interlock contacts, remove the orange harness wire from TB5-1 and wire contacts in series as shown. The contacts must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.
 5. Terminals 11 and 13 of TB5 are for control of Chilled Water Pump 1 (CWP1) starter. Terminals 13 and 15 of TB5 are for control of Chilled Water Pump 2 (CWP2) starter. The maximum load allowed for the chilled water pump relay is 75 va sealed, 360 va inrush at 115 v. Field power supply is not required.
 6. Terminals 12 and 13 of TB5 are for an alarm relay. The maximum load allowed for the alarm relay is 75 va sealed, 360 va inrush at 115 v. Field power supply is not required.
 7. Make appropriate connections to TB6 as shown for Energy Management Board options. The contacts for Demand Limit and Ice Done options must be rated for dry circuit application capable of handling a 24-vac load up to 50 mA.



STANDARD POWER

NON-FUSED DISCONNECT POWER

Fig. 19 — Main Power and Control Connections — 30RA032-055 Without Hydronic Package

Step 7 — Refrigerant Circuit

LEAK TESTING — Units are shipped with complete operating charge of R-22 (refer to Physical Data tables) and should be under sufficient pressure to conduct a leak test. Perform a leak test to ensure that leaks have not developed during unit shipment. Dehydration of the system is not required unless the entire refrigerant charge has been lost. Compressor oil equalization line fittings use O-ring face seal fittings. If a leak is detected at these fittings, tighten fitting $\frac{1}{4}$ turn. If leak persists, open system and inspect the O-ring surface for foreign material or damage. Do not reuse O-rings. Repair any leak found using good refrigeration practice.

DEHYDRATION — Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, Sections 6 and 7 for details. *Do not use compressor to evacuate system.*

REFRIGERANT CHARGE (Refer to Tables 1A-1D) — Immediately ahead of filter drier in each circuit is a factory-installed liquid line service valve. Each valve has a $\frac{1}{4}$ -in. Schrader connection for charging liquid refrigerant.

⚠ CAUTION

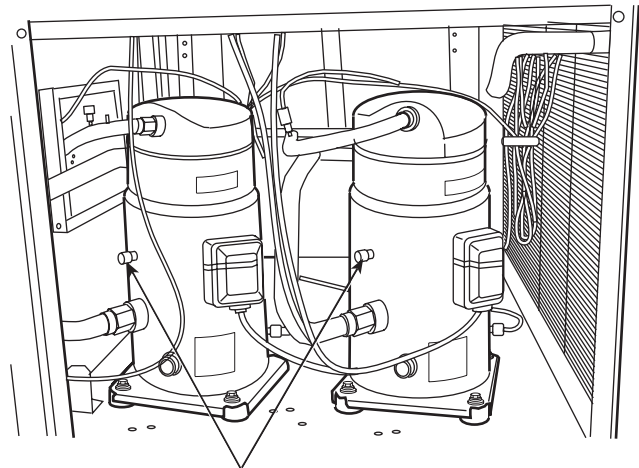
When charging, circulate water through the cooler at all times to prevent freezing. Freezing damage is considered abuse and may void the Carrier warranty.

⚠ CAUTION

DO NOT OVERCHARGE system. Overcharging results in higher discharge pressure with higher cooling fluid consumption, possible compressor damage, and higher power consumption.

If unit is equipped with a Motormaster® V control, the pressure transducer has to be removed from the liquid line Schrader connection to allow for gauge access.

The compressors are provided with a $\frac{1}{4}$ -in. Schrader fitting for connecting to low-side system pressure. The location of the suction access port is shown in Fig. 20.



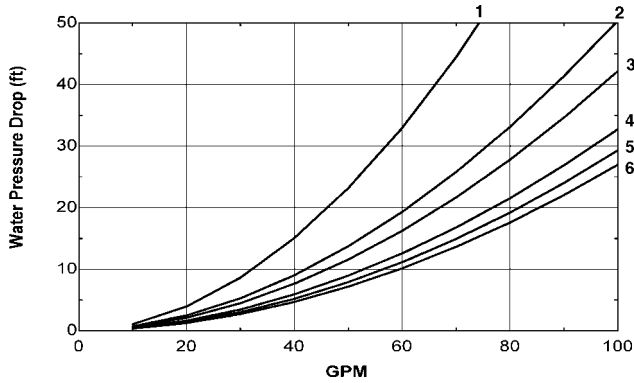
SUCTION ACCESS PORT

Fig. 20 — Suction Access Port

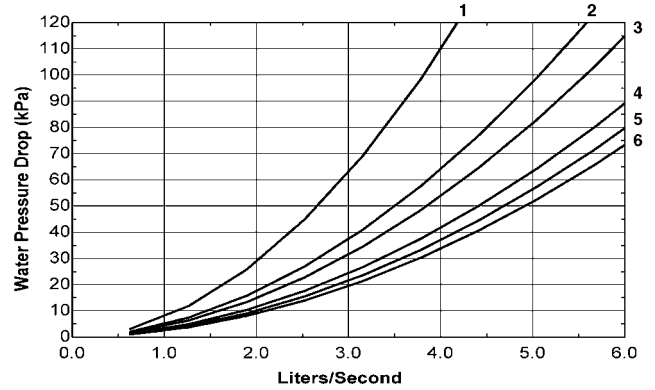
APPENDIX A

Pressure Drop Curves, 30RA010-055

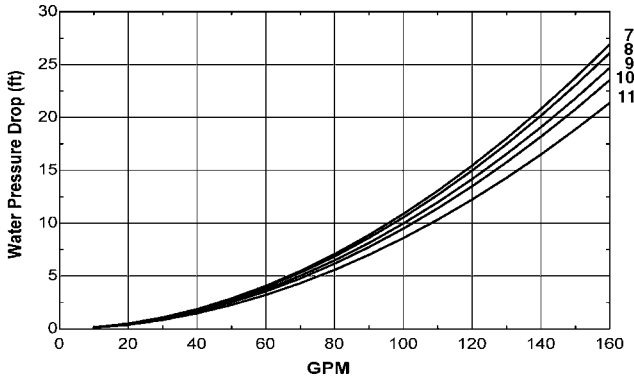
PRESSURE DROP, WITHOUT PUMP UNITS,
30RA010-030



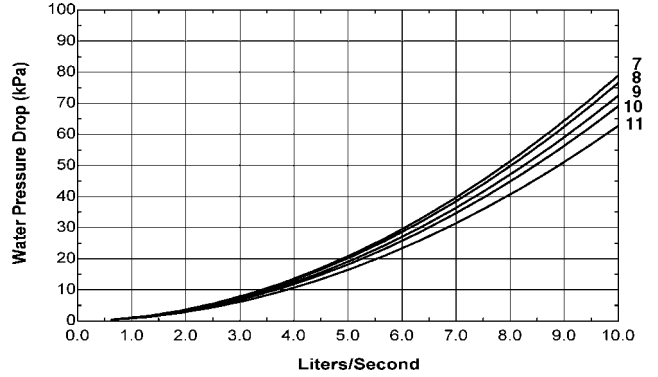
PRESSURE DROP, WITHOUT PUMP UNITS,
30RA010-030



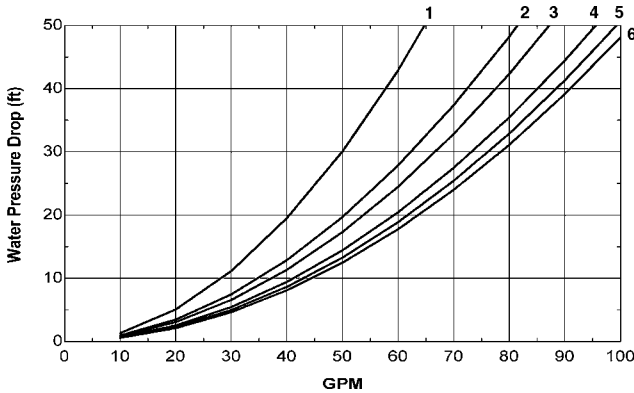
PRESSURE DROP, WITHOUT PUMP UNITS,
30RA032-055



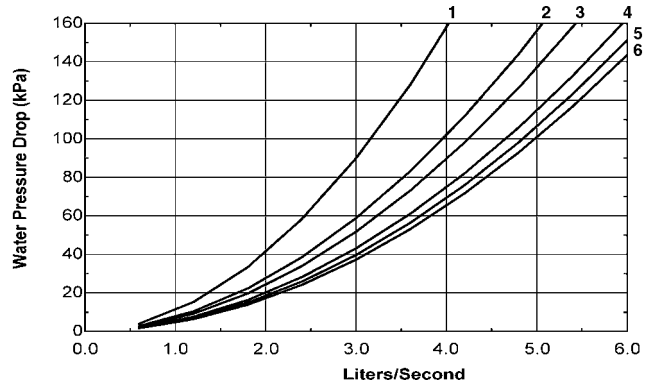
PRESSURE DROP, WITHOUT PUMP UNITS,
30RA032-055



PRESSURE DROP, SINGLE PUMP UNITS,
30RA010-030



PRESSURE DROP, SINGLE PUMP UNITS,
30RA010-030



Use the following formula to convert Feet of water to psi:
Ft of water (.4335) = psi

Use the following formula to convert psi to Feet of water:
Psi (2.306) = Ft of water

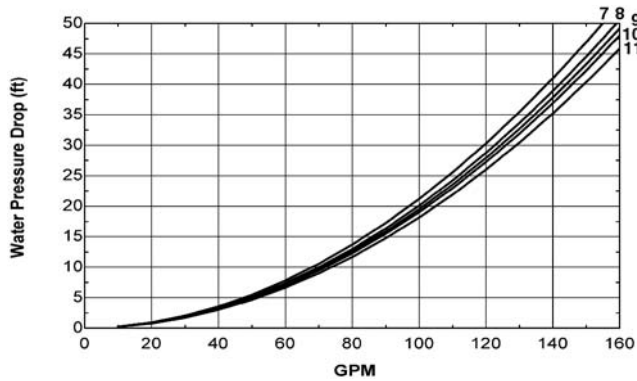
LEGEND

- | | | | | | |
|-------------|-------------|-------------|----------------------|----------------------|--------------|
| 1 — 30RA010 | 3 — 30RA018 | 5 — 30RA025 | 7 — 30RA032, 30RA035 | 9 — 30RA042, 30RA045 | 11 — 30RA055 |
| 2 — 30RA015 | 4 — 30RA022 | 6 — 30RA030 | 8 — 30RA040 | 10 — 30RA050 | |

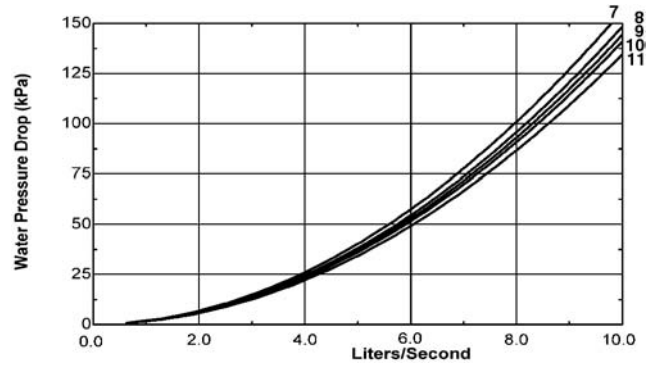
APPENDIX A (cont)

Pressure Drop Curves, 30RA010-055 (cont)

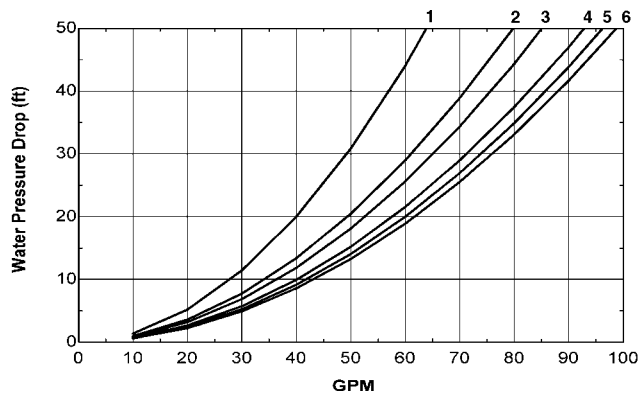
PRESSURE DROP, SINGLE PUMP UNITS,
30RA032-055



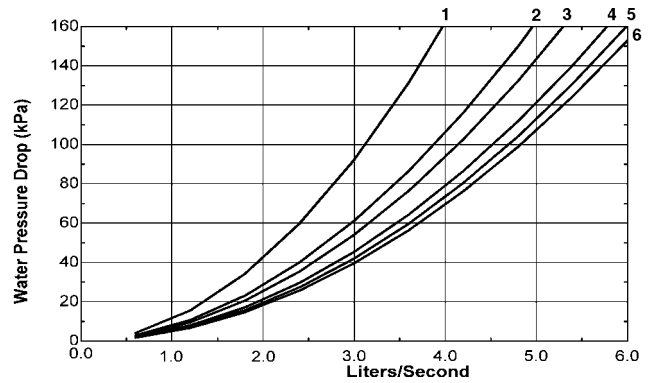
PRESSURE DROP, SINGLE PUMP UNITS,
30RA032-055



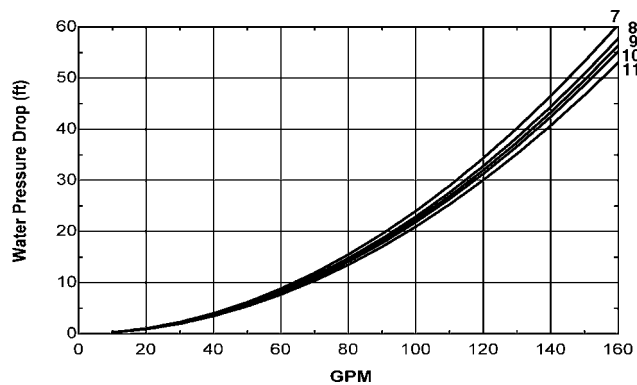
PRESSURE DROP, DUAL PUMP UNITS,
SIZES 30RA010-030



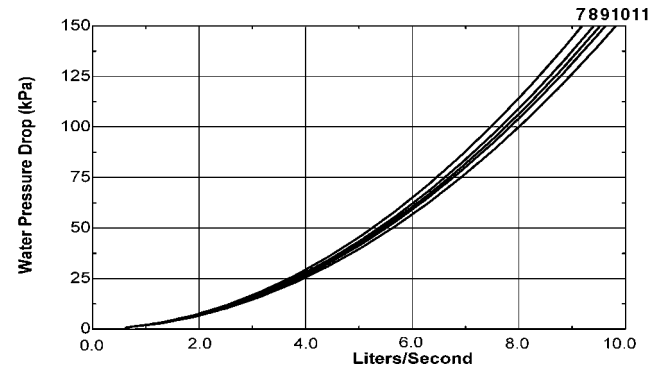
PRESSURE DROP, DUAL PUMP UNITS,
SIZES 30RA010-030



PRESSURE DROP, DUAL PUMP UNITS,
SIZES 30RA032-055



PRESSURE DROP, DUAL PUMP UNITS,
SIZES 30RA032-055



Use the following formula to convert Feet of water to psi:
Ft of water (.4335) = psi

Use the following formula to convert psi to Feet of water:
Psi (2.306) = Ft of water

LEGEND

| | | | | | |
|-------------|-------------|-------------|----------------------|----------------------|--------------|
| 1 — 30RA010 | 3 — 30RA018 | 5 — 30RA025 | 7 — 30RA032, 30RA035 | 9 — 30RA042, 30RA045 | 11 — 30RA055 |
| 2 — 30RA015 | 4 — 30RA022 | 6 — 30RA030 | 8 — 30RA040 | 10 — 30RA050 | |

APPENDIX A (cont)

Pressure Drop Curves, Accessory Storage Tanks

