Prodigy

Flake and Nugget Ice Machines
Technical Introduction

September 2009

Scotsman®

Introduction

- Overview
- Installation
- Operation
- Maintenance
- Diagnosis
- Service

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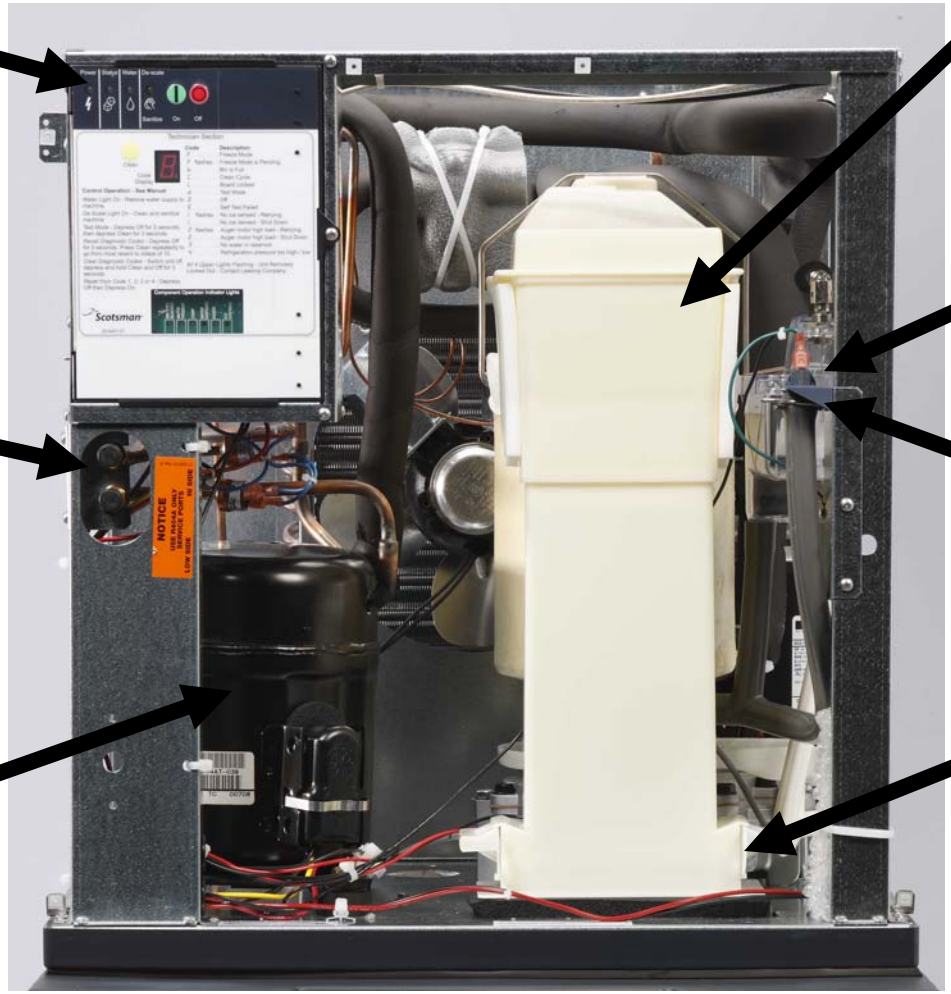
Overview

- Replacing certain current flaked and nugget models
- New Stuff
  - Control system
  - Cabinet
  - Some refrigeration components
- Good Stuff carried forward
  - Breaker & bearing
  - Auger
  - Evaporator
  - Gear reducer

Quick Review: What is a flaker?

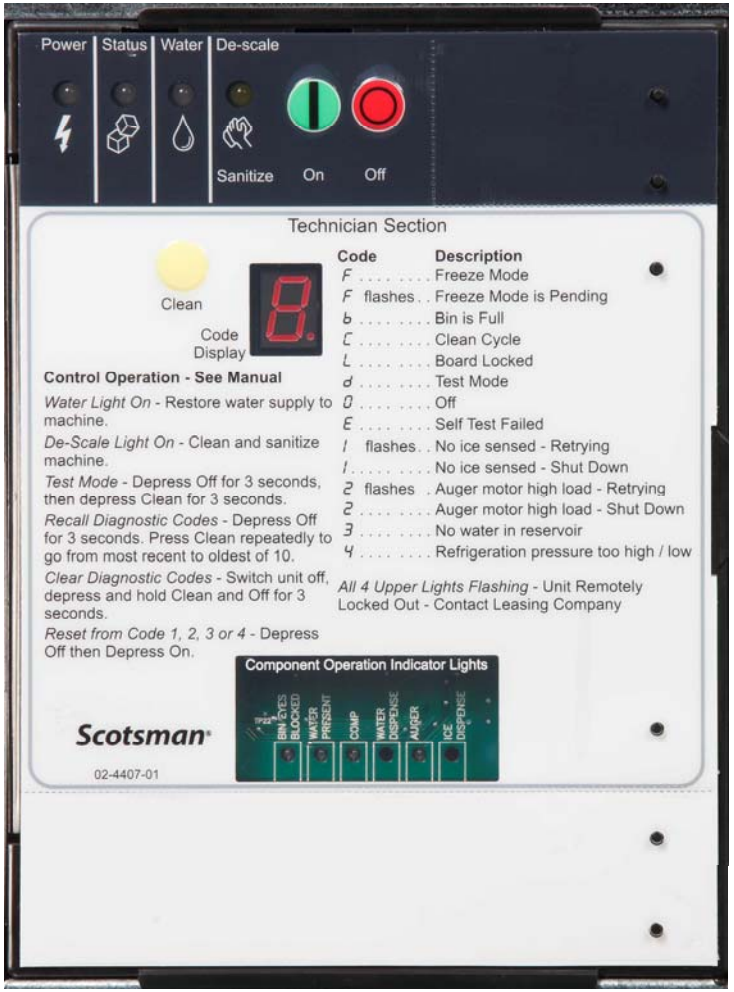
- A continuous flow ice machine
  - Vertical, water filled, refrigerated cylinder
    - With internal CCW 11 RPM auger driven by a gear reducer
  - Constant water in and ice flow out
  - Ice crystals continuously form in the evaporator
    - Forced up by the auger and squeezed out thru slots or holes
  - Makes flaked or nugget ice by an extrusion process
    - Flaked ice: 6 large slots to push ice thru
    - Nugget ice: 16 holes

Components

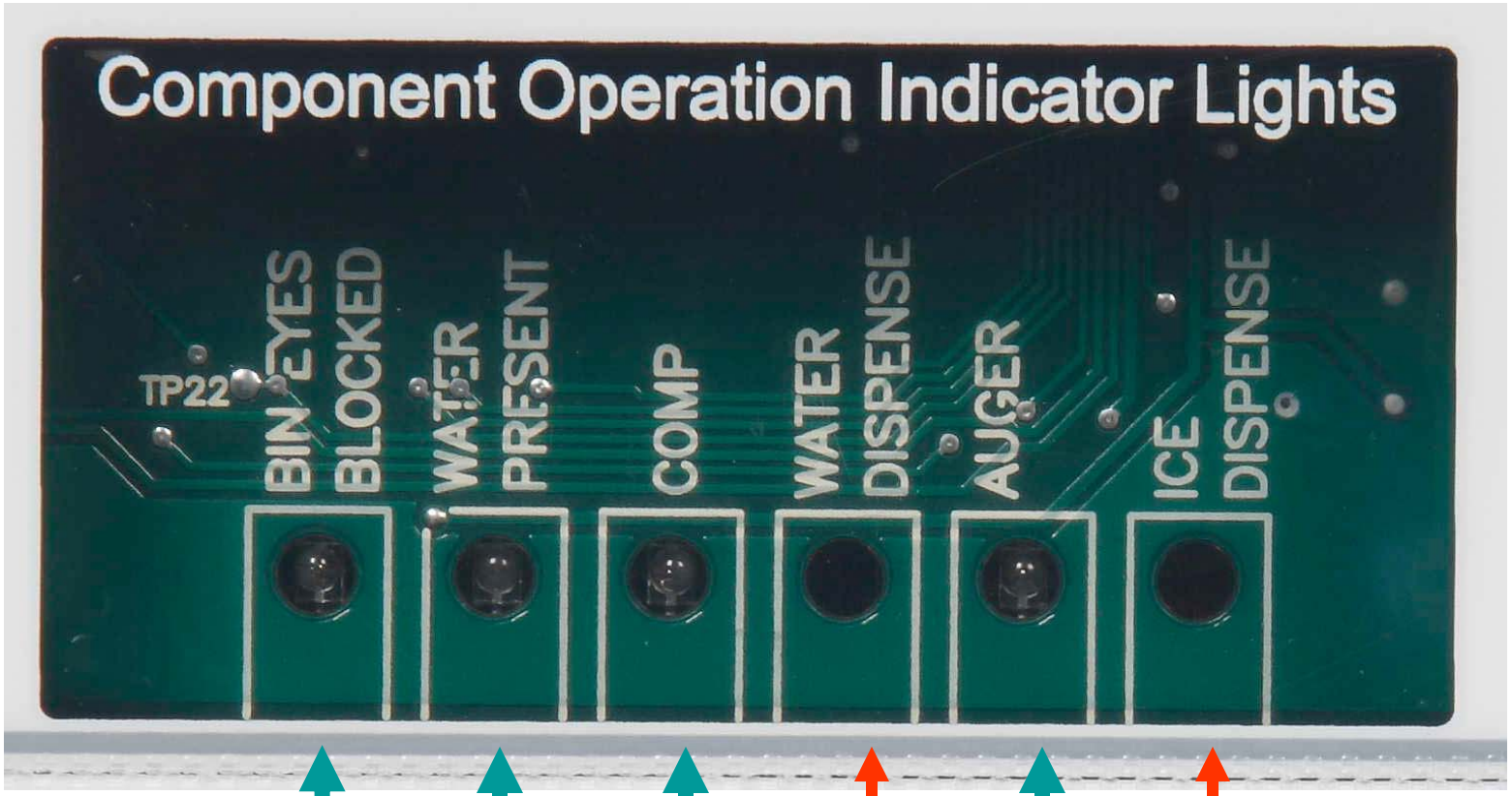

Controller
Ice Chute
Float Reservoir
Access Valve
Water Sensor
Remote Liquid Line Access Valve on Back Panel
Photo Eyes
Compressor

Scotsman Prodigy Flaker

- Operated by an electronic controller
  - Controls compressor and auger motor
  - Senses ice, water, system pressure switches



Component Indicator Lights



Bin Eyes Blocked

Water Present

Comp

Not Used

Auger

Not Used

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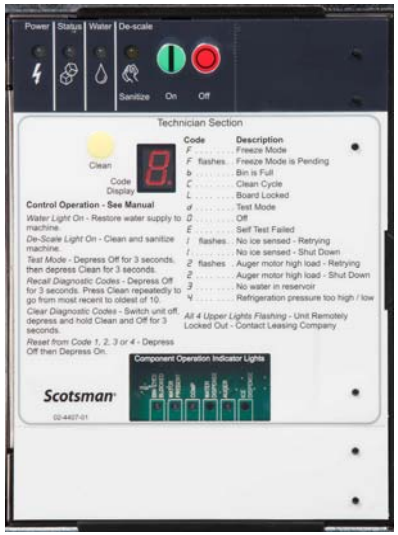
New Stuff: Model Line Up

- F = Flaker, N = Nugget. Example: N0422A-1A
- 04 thru 15 = ice capacity in 100s of lb
- 22 = cabinet width
- A = air cooled, W = water cooled, R = remote, L = low side
- Voltage:
  - -1 = 115/60/1
  - -32 = 208-230/60/1
  - -3 = 208-230/60/3
  - -6 = 230/50/1

New Stuff: Control System



- Prodigy AutoAlert lights
  - Power, Status, Water, Cleaning
- Component indicator lights
  - Compressor, Auger Drive, Water, Photo Eye
- Cleaning mode
- Test mode
- Water sensor
  - Use RO water to 10 microSiemens/cm conductivity (~ 7 PPM)
- AutoSentry Plus: Enhanced with No Ice Sensed, auto voltage detection & amp trip setting
- Options
  - KVS & Smart-Boards (KSBU, KSBU-N, TPDL2)

New Stuff: Cabinet

- 22 inch width
- 23 or 27 inch height
- 24 inch depth
- Reinforced base
  - Drop zone position changed
  - KVS sensor mounting socket included
- External air filter
- Optional air baffle

New Stuff: Refrigeration

- Compressors
  - Tecumseh in smaller models and Copeland in larger
  - F1222 / N0922 single phase is Tecumseh
  - F1222 / N0922 three phase is Copeland
- Air cooled condensers
  - Air flow front to back
- Remote condensers
  - ERC111 and ERC311

Stuff Carried Forward

- Ice making system
  - Auger
  - Gear reducer
  - Breaker & bearing
  - Photo eyes
- Five 42” nugget and flaker models
  - FME2404AS-32B
  - FME2404AS-3B
  - FME2404RS-3B
  - FME2404RLS-32B
  - NME1854RS-32B

Remote Low Side Models

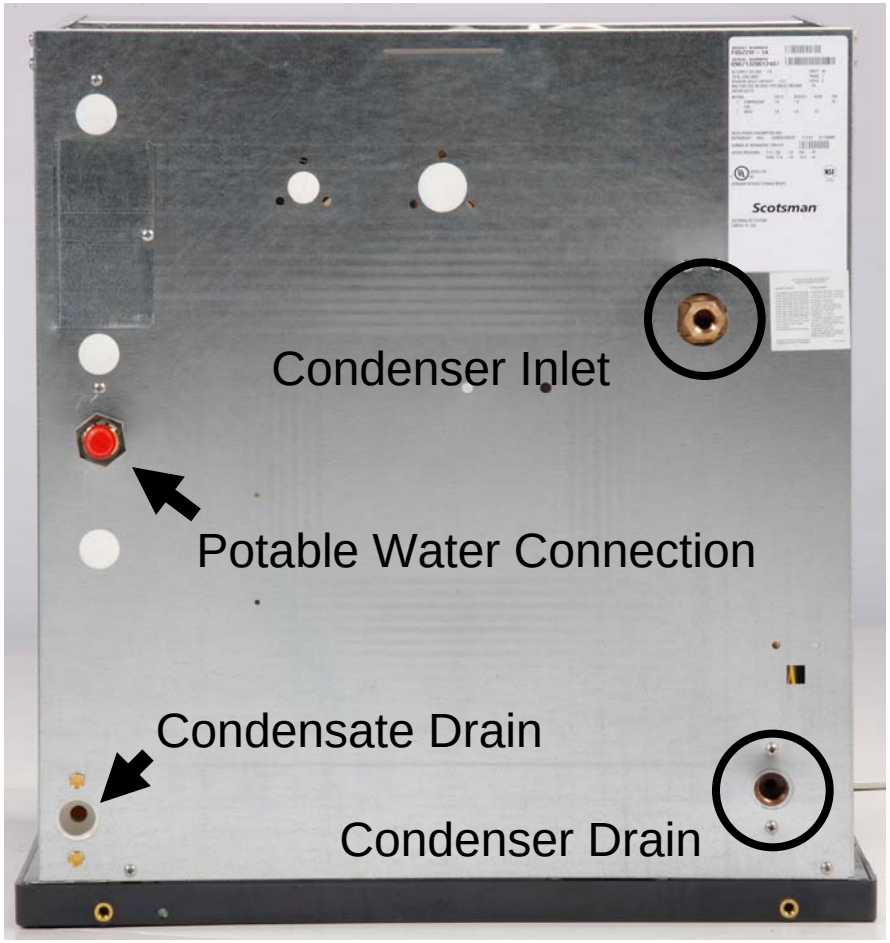
- Head contains
  - Evaporator assembly
  - Gear reducer
  - Control system
  - Liquid line, TXV and EPR valves
    - EPR set at 36 PSIG
- For rack or dedicated condensing unit
  - Stub refrigeration connections
    - 3/8” liquid, 5/8” suction
  - R-404A only

Bin Applications

- B322, no adapter needed
- B330 and B530 series, KBT27
- B842 – KBT39
- B948 – KBT38 (1 unit) KBT38-2X (2 units)
- BH1100/1300/1600
  - No adapter needed, adjust filler panels to fit

Installation

- Easy utility connections
  - Water inlet
  - Condensate drain
  - Power
- 22” wide mounts directly on matching bins and, if Nugget Ice, dispensers
- New bin tops for 42” and 48” bins



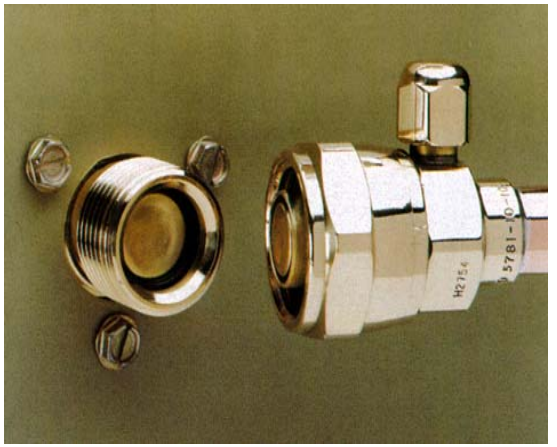
Installation Example

- F0522A-1 on B322S
  - Place unit on bin
  - Level assembly
  - Connect and vent rigid drain tubing to ¾” FPT condensate drain fitting
  - Connect separate bin drain
  - Connect potable water supply to 3/8” male flare fitting
  - Connect proper voltage power to lead wires in back of cabinet.

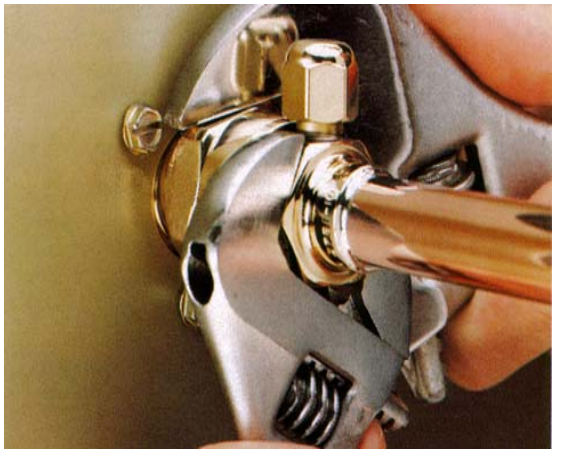
Prodigy Installation – Remote Air Cooled

- MUST use condensers with headmaster in them:
  - ERC111 or ERC311
  - Existing system Head-only replacement
    - KPFHM Kit adds headmaster at head end of tubing
- RTE line sets – 10, 20, 40, or 75 foot lengths
  - 3/8 liquid, 1/2 discharge
  - Lubricant tube included
- Power supplied by ice machine for fan motor
- Same limitations as other current models

Remote Installation



Clean and **Lubricate** Quick Connect Couplings



Use Two Wrenches to Tighten

Rotate Swivel Nut **One Quarter Turn** More After Nut Becomes Tight

Incomplete Assembly: One Thread Showing

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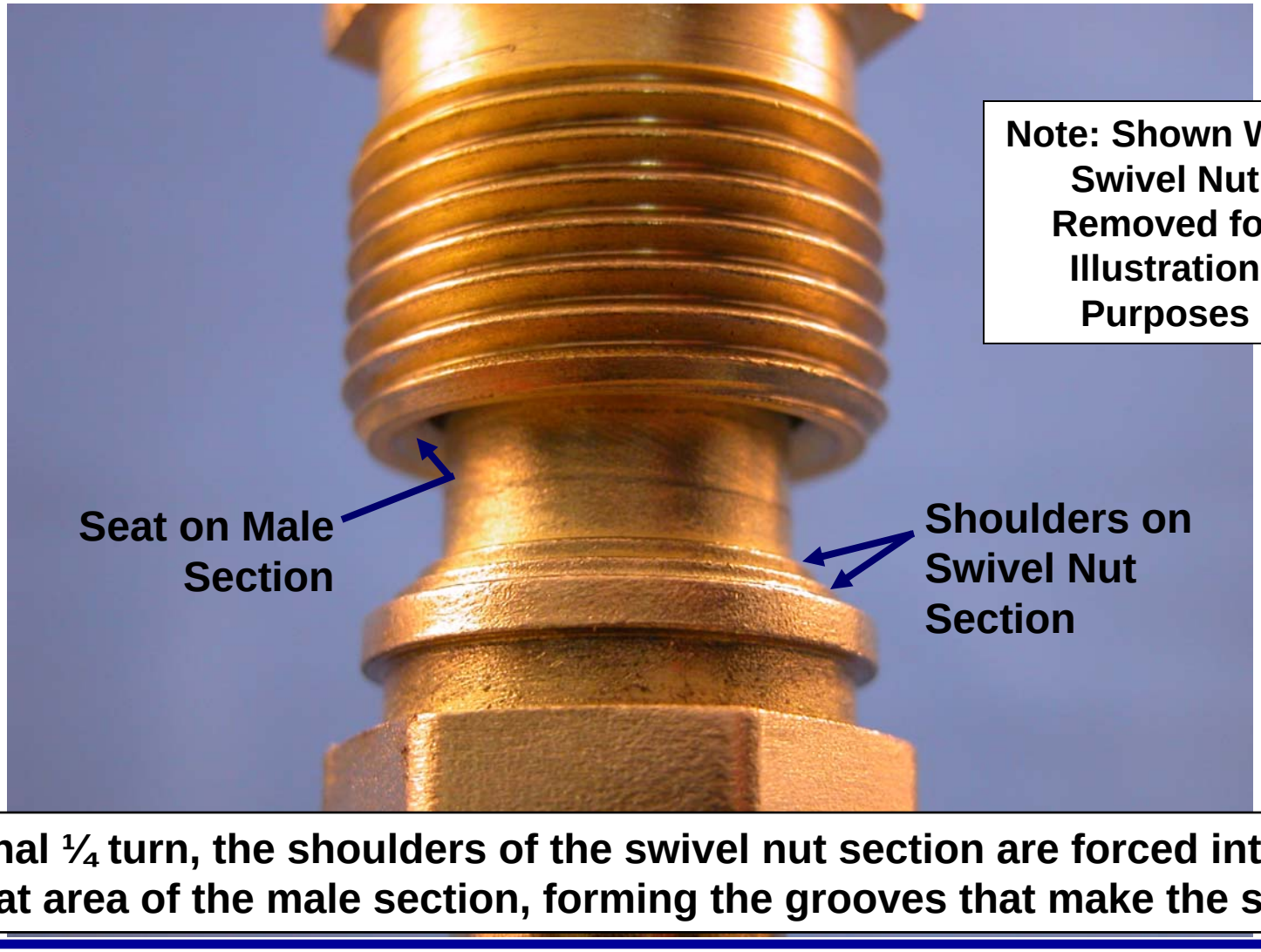
Quick Connect Joint



At final ¼ turn, the shoulders of the swivel nut section are forced into the seat area of the male section, forming the grooves that make the seal

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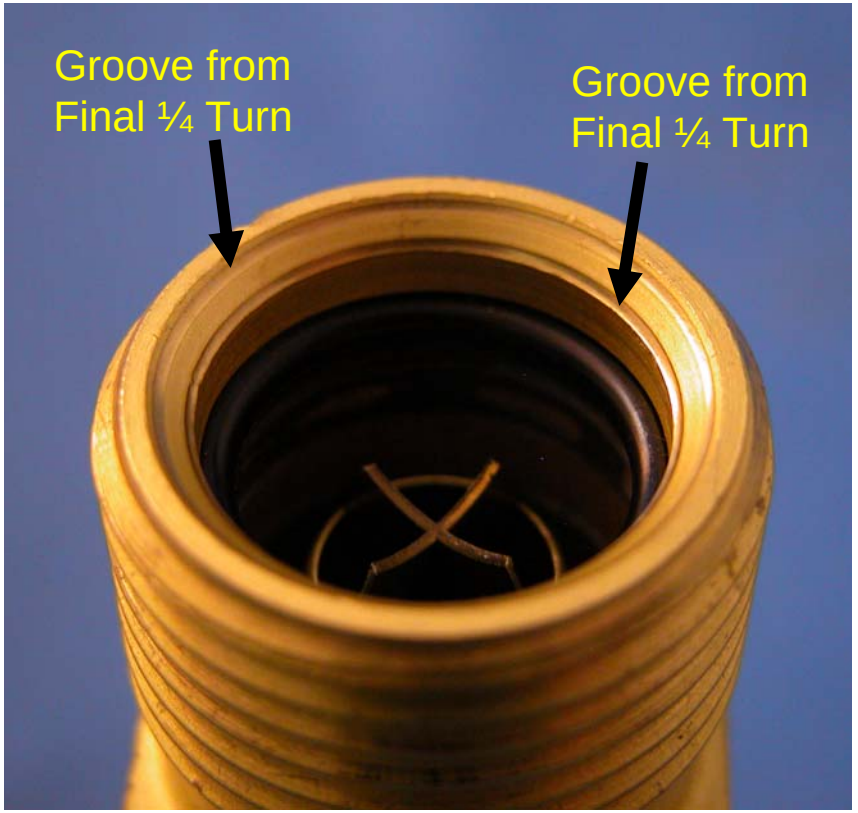
Coupling Sealing

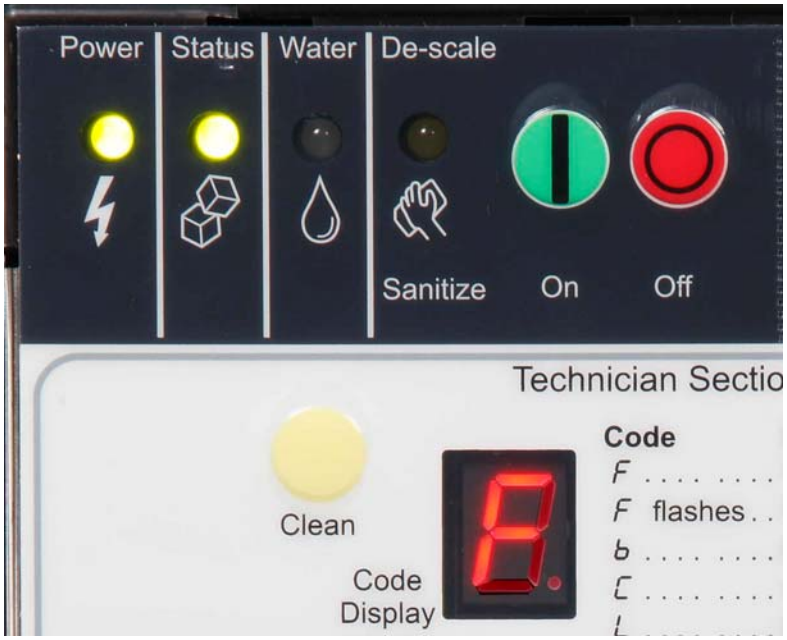
Before



After

Start Up

- Push and release the On button
  - F code displayed
  - Status light ON
  - Auger drive motor will power up
  - Compressor will power up
    - Fan motor operates with compressor



Electrical Sequence – Start Up

- Pre-start
  - Ice sensor sees empty chute (call for ice)
  - Water sensor has conductivity at probes (water OK)
- On button push starts unit
  - Auger motor starts
  - Compressor and fan motor start
- Controller checks for ice falling
  - Check begins 6 minutes after a restart
  - Must sense ice in a 10 minute span or shuts unit down (Code 1)

Electrical Sequence – Shut Down

- Infrared light to photo eye receiver blocked by ice in chute
- Signals controller to shut down
- Controller shuts off compressor (AC or WC) or liquid line valve (RC or RL)
- Auger motor operates for 60 seconds to clear evaporator of ice
- Remote will pump down until low side pressure drops below 15 PSIG.

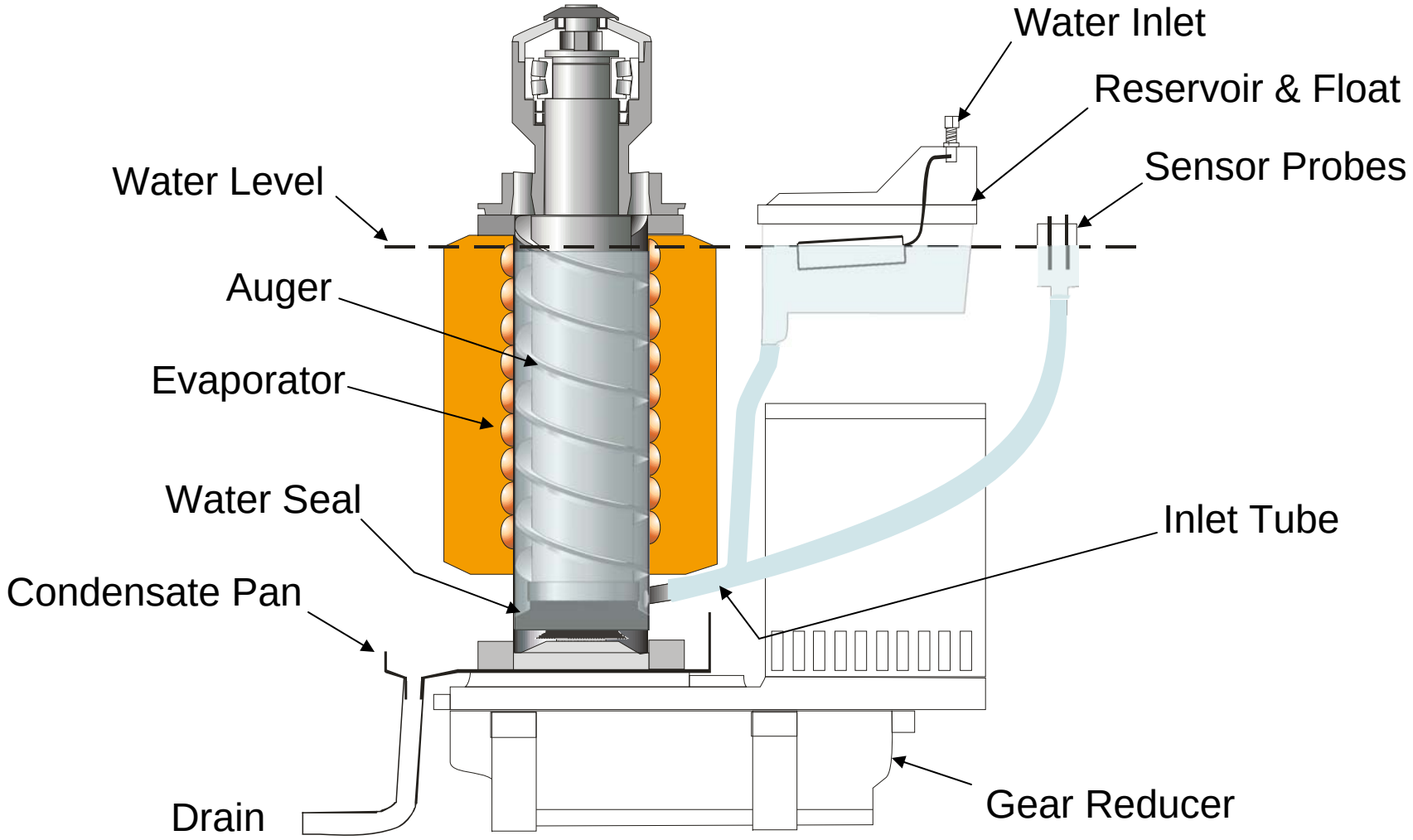
Bin Control Methods

- Standard: Photo eye set
  - Infrared emitter and receiver at base of chute
- Optional: KVS
  - Control and sensor
  - Sensor mounts in base of unit
  - Ice level is adjustable
- Optional: Bin stat (opens on temperature fall)
  - Mounts to control box strut
  - Connects to blue wires in control box

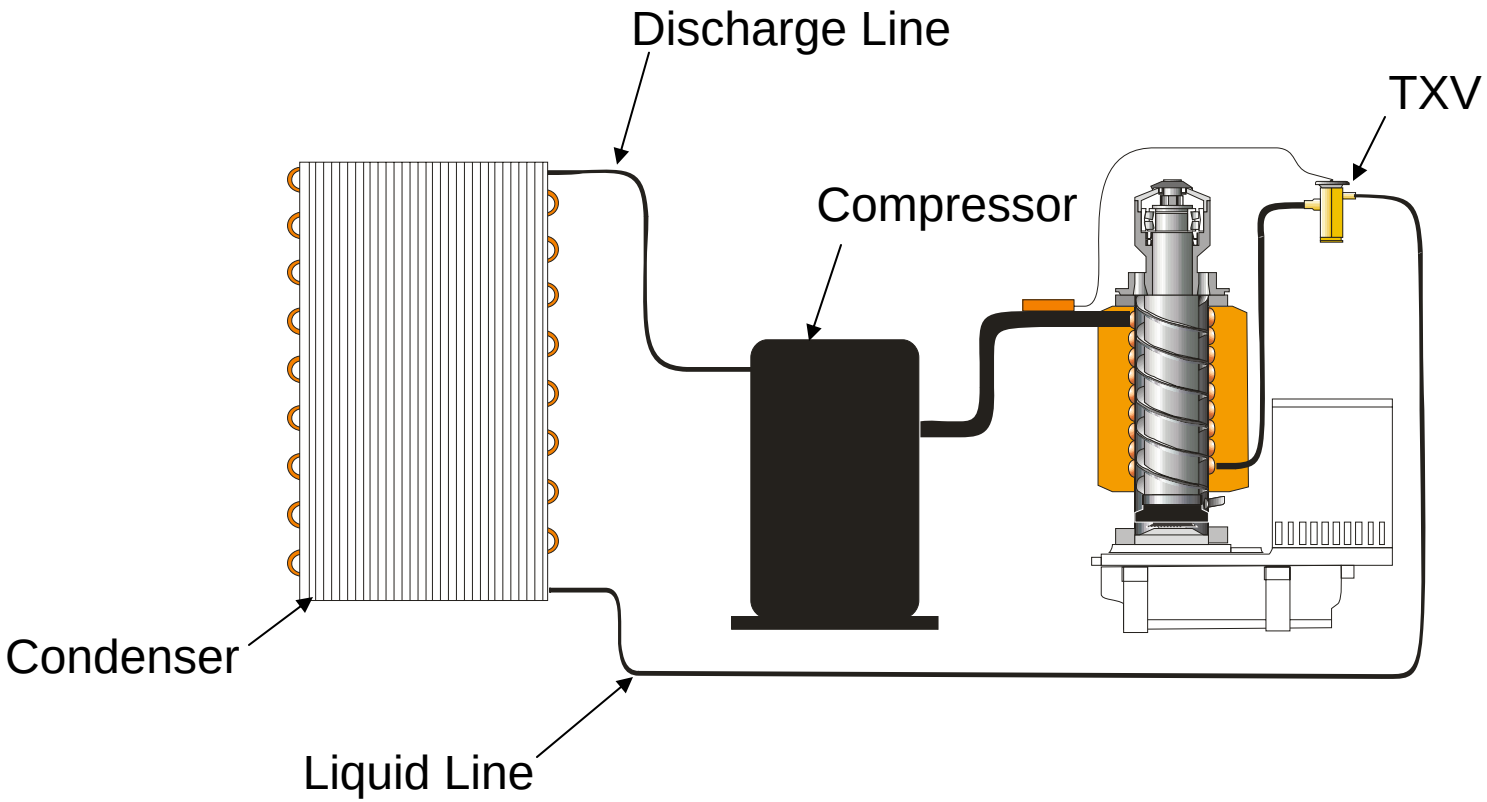
Power or Water Interruptions

- Power supply lost and restored
  - Automatic restart
  - 4 minute delay to restart
  - F code blinks until unit starts
- Water supply lost and restored
  - Automatic restart
  - 4 minute delay to restart

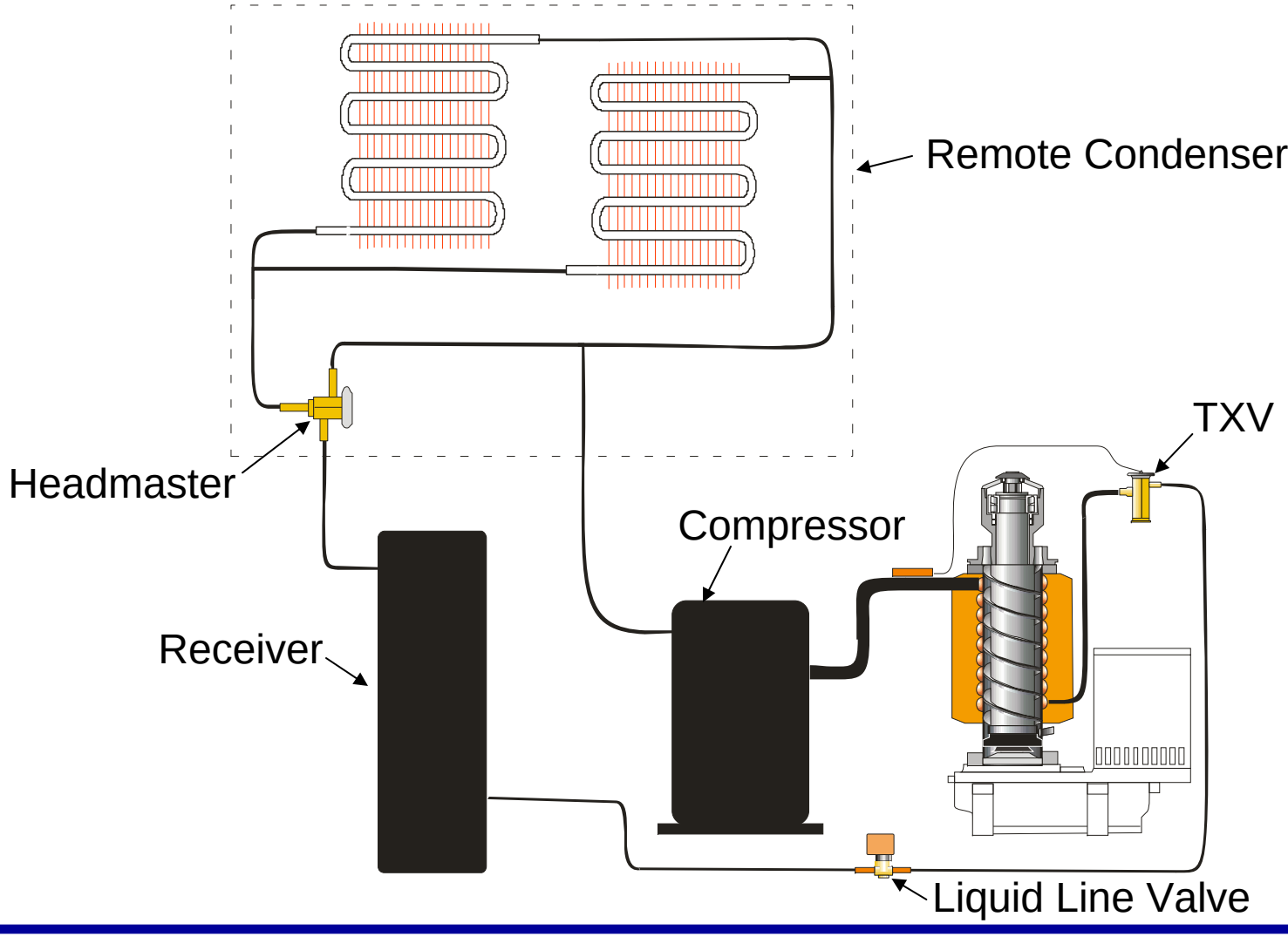
Water Schematic



Refrigeration Schematic, Air Cooled



Refrigeration Schematic, Remote Air



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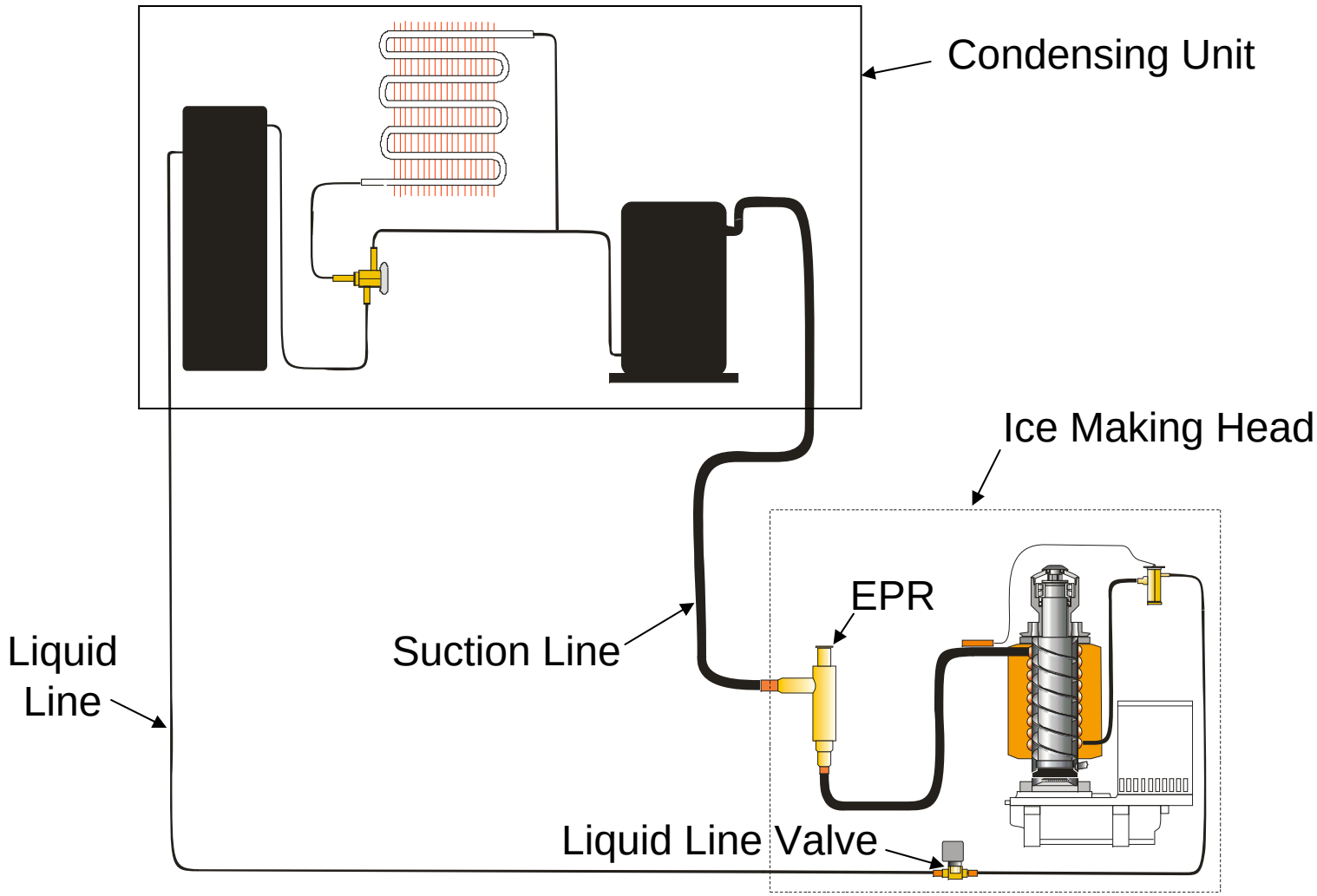
Refrigeration Schematic, Remote Low Side



AutoSentry Plus

- AutoSentry monitors auger motor current
  - Overloaded motor draws more current
  - High current triggers shut down
  - Code 2 displayed
  - Retry in 4 minutes
  - 2 restart attempts to manual reset
- AutoSentry Plus adjusts the current cut out point based on the voltage supplied
  - Example, at 115 volts supply voltage, the cut out point is 6 amps; 230 volt cut out point is 3 amps

Display Codes

F = Freeze mode

b = Bin full

C = Clean cycle

L = Locked

d = test mode

0 = Off

E = self test failed

1 = No ice sensed

2 = Auger motor over amp

3 = No water sensed

4 = Refrigeration system pressure too high / low

Manual codes:

0, 4, 6, 1 = time interval to Clean Light On settings

A blinking code means a mode change – will restart or has restarted

Change De-Scale Notification Interval

- Access from standby (Status Light Off).
- Press and hold Clean button for 3 seconds.
  - Allows changes and Displays the current Time To Clean setting
- Press the Clean button to cycle through the 4 possible settings:
  - 1 year
  - 0 (disabled)
  - 4 months
  - 6 months (default)
- Push Off to confirm the selection

Maintenance – Recommended Every 6 Months

- Water System
  - Scale removal
    - Shut off water
    - Drain reservoir
    - Cover photo eyes to protect from spills
    - **Mix** 3 quarts hot water to 8 ounces Clear 1 scale remover **– do not NOT pour in undiluted!**
    - Fill reservoir – and keep full until all solution is used, then turn water on

Maintenance – Scale Removal

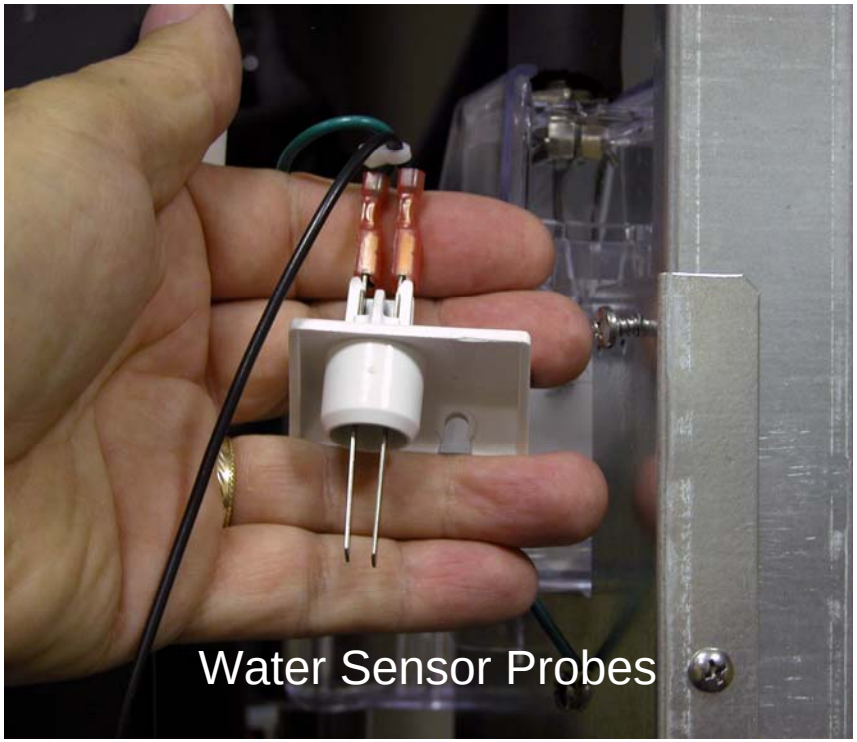
- Clean mode
  - Push Clean button
  - Timed soak / auger in motion – 20 minutes
  - Timed run / ice making – 20 minutes **keep reservoir full of solution**
  - Resets clean light

Mineral Scale

Extreme Scale Build Up on Evaporator Wall

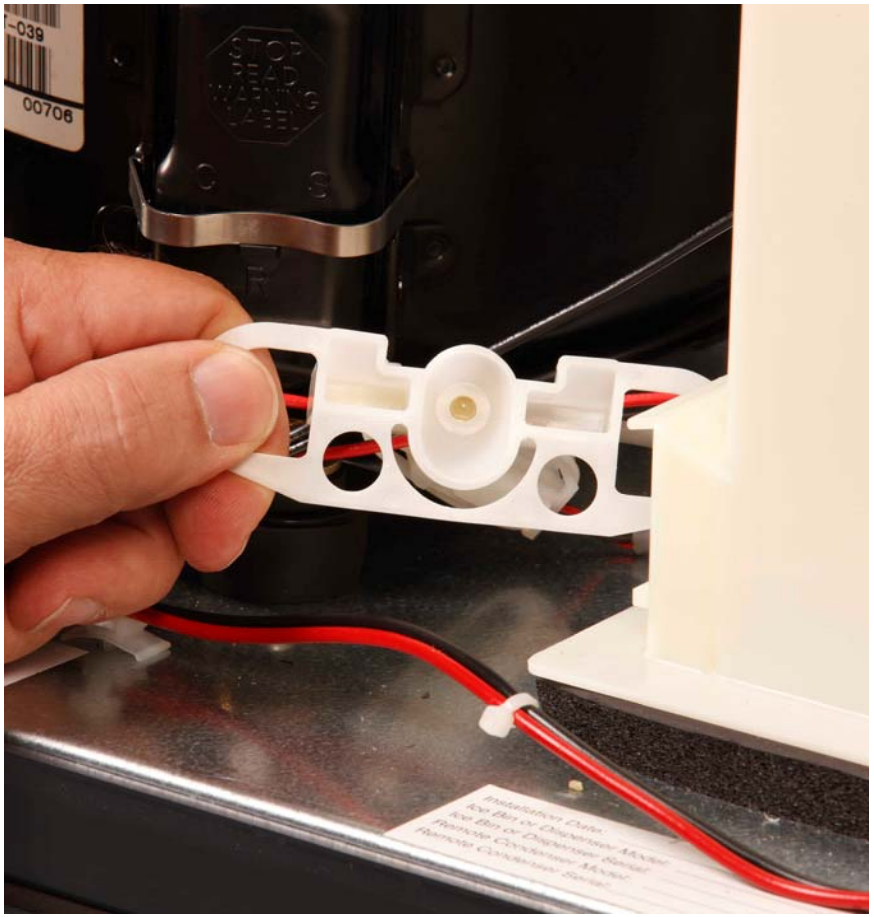
Maintenance

- Check mechanicals
  - Clean air filter
  - Clean Water Sensor
  - Ice Sensor
    - Clean eyes
  - Top bearing
    - Check / Repack
  - Water seal
    - Check condensate pan
  - Gear reducer bolts
    - Check torque
      - 275 inch pounds


Water Sensor Probes

Maintenance

- Clean ice sensors
  - Photo eye set
  - Slide out to remove
  - Wipe with diluted ice machine scale remover



Bearing Access

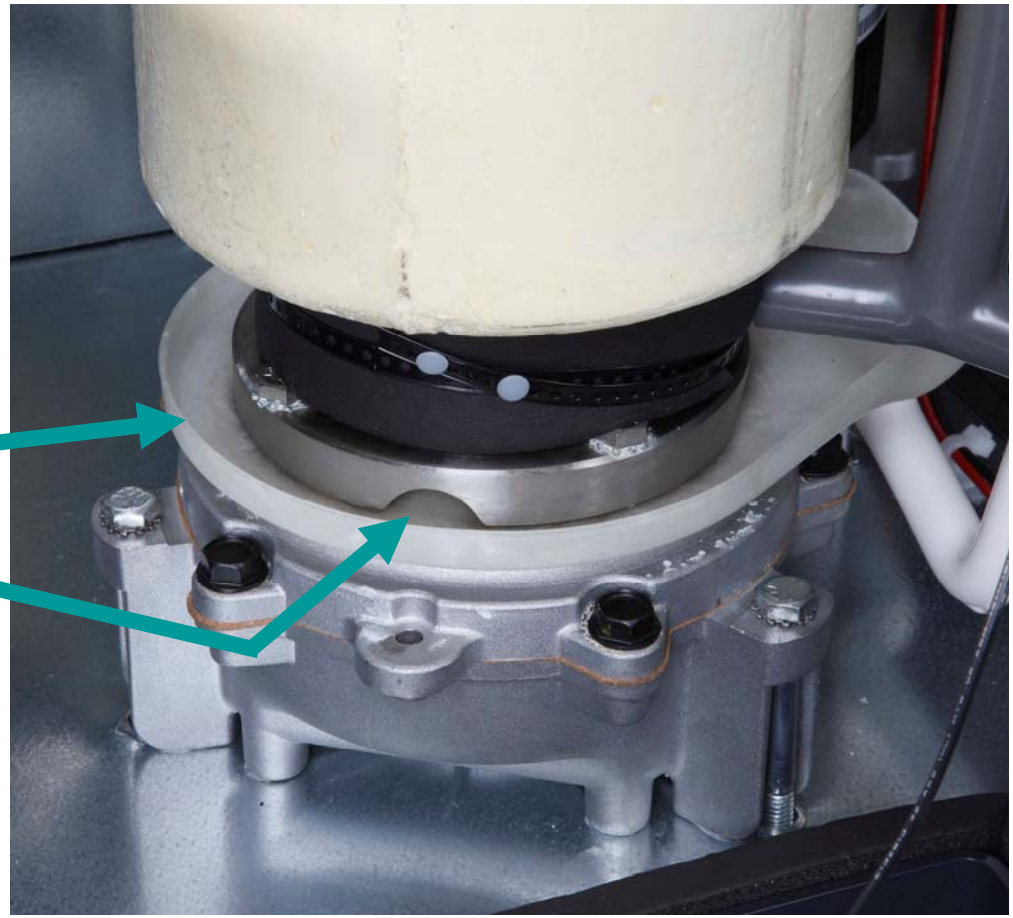
- Push bail clamp back
- Remove chute cover
- Remove ice sweep
- Remove breaker cover
  - Left hand threads

Maintenance

- Bearing service
  - Grease all white – OK
  - Grey streak – add grease to check
  - All grey - repack
    - Repack with grease needle
- Replacement
  - Use arbor press to remove and press in new bearing

Maintenance

- Water Seal
  - Check condensate pan
  - Water seal leak drains into pan

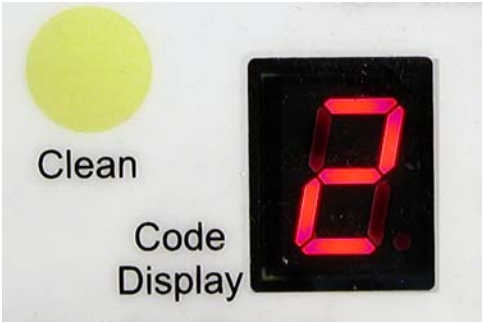


Diagnostics

- Code 1: No ice sensed
  - Rule out: high or low pressure cut out (Code 4)
  - Rule out: no water (Code 3)
  - Auger motor over amp (Code 2)
  - Check:
    - Excessively hot conditions – restricted air flow
    - Dirty air filter or condenser
    - Lack of refrigeration – charge, expansion valve, fan motor, headmaster

Diagnostics

- Code 2: Auger motor overloaded
- Auto restarts 2 times
- 4 minutes between restarts
  - Check
    - Motor condition
    - Liquid line valve for leak thru (remote low side)
    - Scale on evaporator & auger
    - Bearing condition
    - Gear reducer condition
    - Compressor contactor sticking
    - Low pressure control (remote pump down) not opening



Diagnostics

- Code 3: No water in reservoir
  - Check filters
  - Check float valve
  - Check sensor
    - Two-Probe Sensor in leg of hose to evaporator
    - Test: short probes together
      - Turns indicator light on
      - Space between probes turns light off

Diagnostics

- Code 4: High or Low Pressure Control Open
  - Pressure controls are automatic reset type
  - Code 4 indicates one of them opened
    - Unit off, Code 4 means one is still open
    - Unit on, Code 4 in recall code list – was open in past
  - Restart unit to check
    - High (Cut Out 450, Cut In 350):
      - Water cooled may be water interruption
      - Air cooled may be fan motor
    - Low (Cut Out 15, Cut In 30):
      - TXV superheat too high
      - Charge too low
      - Auger motor or auger not turning

Controller Button Process

- Reset controller
  - Push Off, then On
- Recall Diagnostic Codes
  - Hold Off button in for 3 seconds
  - Push Clean button to cycle thru the stored codes
- Clear Diagnostic Codes
  - From Standby – Status Light OFF
  - Push and HOLD Clean and Off buttons for 3 seconds

Diagnostics

- Unit off, **b** in code display, bin is not full
  - Check “Bin Eyes Blocked” indicator light
  - Scale on photo eyes, clean and recheck
    - If clean and Bin Eyes Blocked light is ON, replace eye set
  - Photo eyes out of mounting slot
  - Ambient light on photo eyes
  - Photo eye failure
  - Optional KVS set too low or sensor out of socket
  - Optional Bin Stat is open

Diagnostics: Refrigeration

- Low charge symptoms
  - High superheat
    - Normal is 10 - 15 degrees F. but varies with ambient
  - Overheated compressor
    - Note: Normal Tecumseh dome temperature is hot
  - Low ice making capacity
  - Low suction pressure
    - 400 - 500 lb **normal is 37 - 40 PSIG** – higher at high ambient
    - 600 – 800 lb **normal is 32 - 36 PSIG**
    - 900 lb + normal is **25 - 30 PSIG**

Diagnostics – Low Capacity

- Clean machine first
  - Scale build up will cut capacity
- Test by catching ice
  - Operate unit for 10 minutes prior to test
  - 15 minutes weight x 96 = 24 hour capacity
  - Low capacity units will be very low

Service

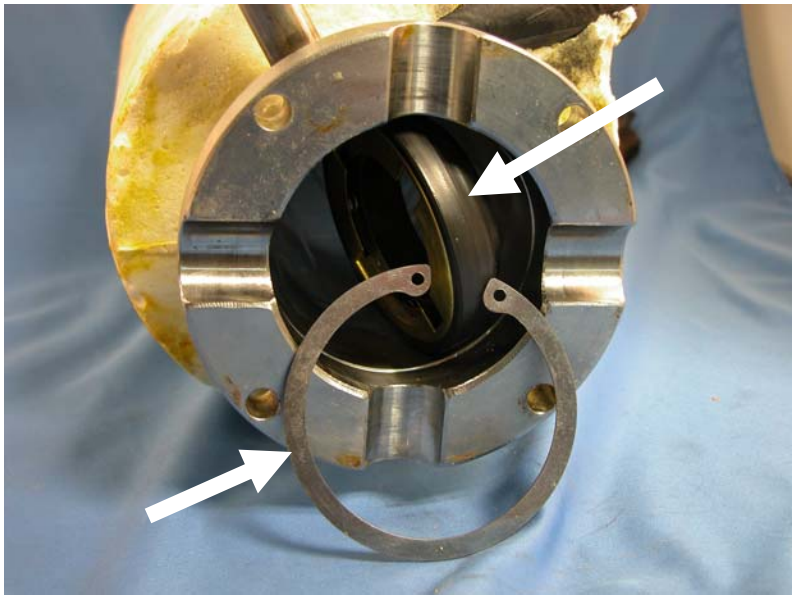
- Remove the Auger
  - Shut off water
  - Drain reservoir & evaporator
  - Push bail clamp back
  - Remove cover
  - Remove ice sweep
  - Remove upper chute

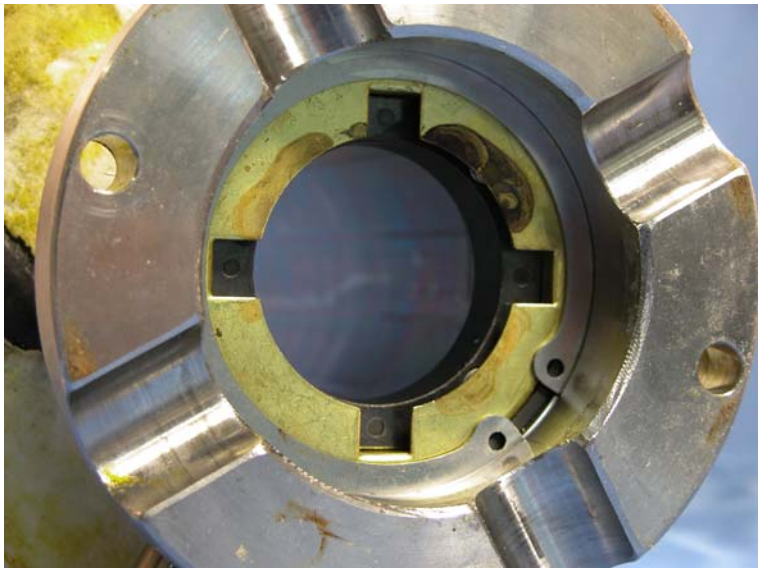
Service

- Loosen auger stud
- Remove 4 allen head bolts
- Lift Auger out, dry off
  - Works best clean & bright
  - Examine auger edges
    - Excessive bearing wear will cause auger damage
  - Check evaporator wall for scale
- Replace Water Seal

Water Seal Replacement

- Remove auger
- Separate from gear reducer
- Remove retainer and stationary half of seal

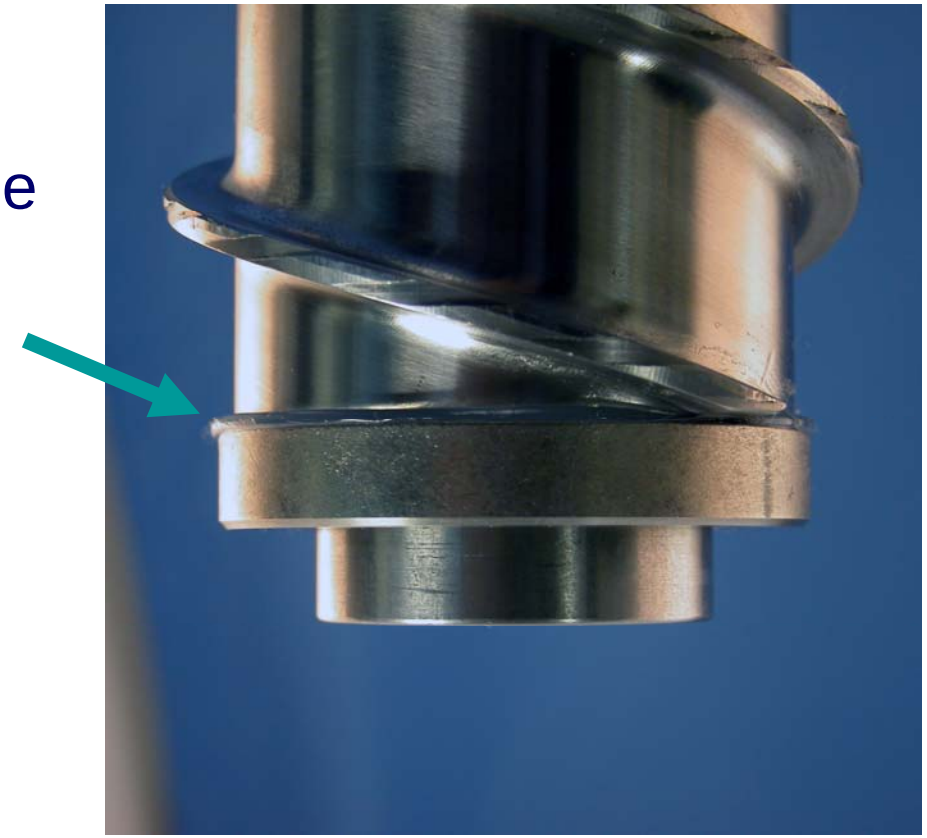




- Lubricate new seal half
- Insert seal into tube
- Install retainer
- Reposition seal onto retainer

Water Seal Replacement

- Rotating Half
  - Clean auger shoulder
  - Add bead of food grade sealant to shoulder
  - Lubricate rubber
  - Slide onto auger
  - Sealant fills gap

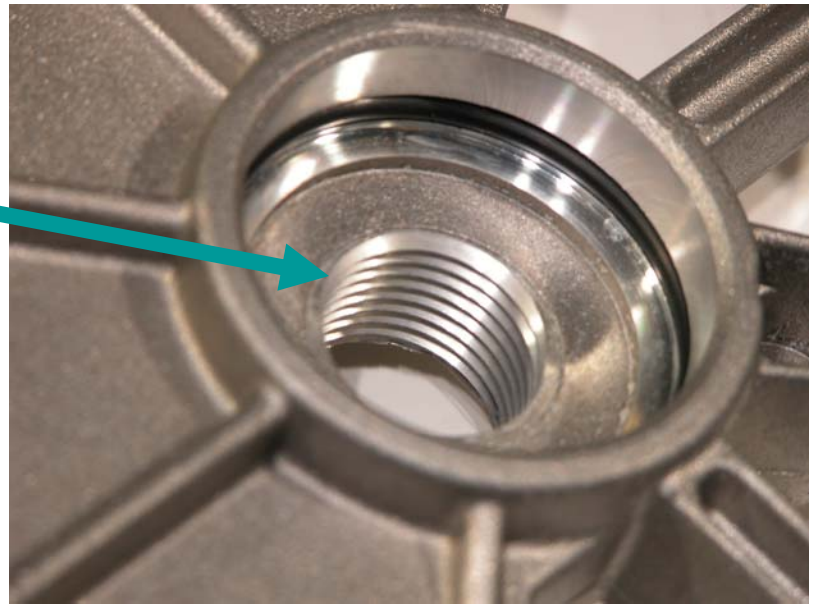


Service: Top Bearing

- Remove auger stud
- Separate breaker from auger, check bearing
  - Remove / Replace bearing using arbor press
  - Install new lip seals, cup side up
    - 2” PVC coupling install tool
    - Lube seals with food grade grease before installing bearing

Service: Gear Reducer

- Auger motor
  - ¼ HP split phase
- Gear reducer
  - Three gears
    - Phenolic resin first gear for noise suppression
  - Labyrinth input seal
  - 14 ounce lube charge
- Split case to check

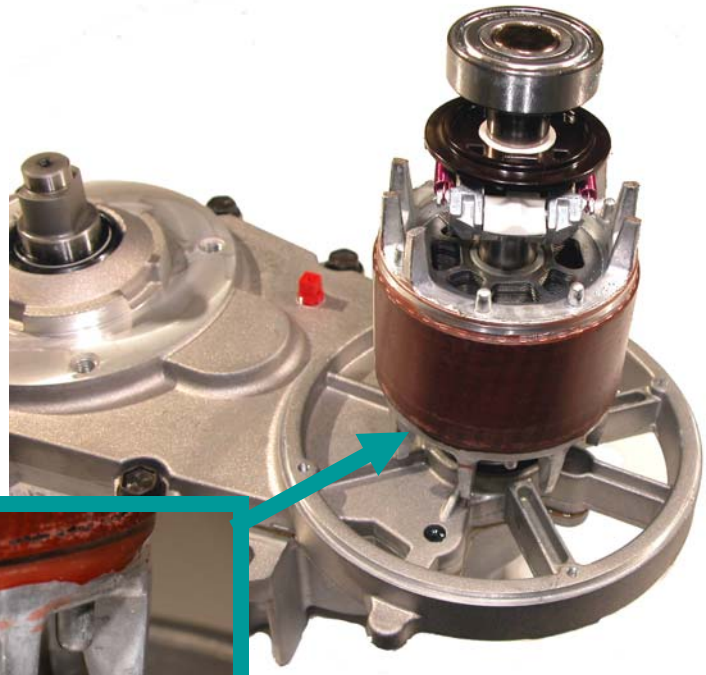


Gear Reducer

- Remove motor
- Check oil level
  - 3/16” on tip is normal

Service: Auger Motor

- Motor shipped with end bell, rotor and stator
- Must fully seat rotor & bearing into case cover



Service: Refrigeration

- All models are critically charged
- Recover and weigh charge out
- Replace dryer
  - Filters in condenser do not need replacing
- Purge with dry nitrogen while brazing
- Evacuate to at least 300 microns
  - Factory evacuation is to 50
- Weigh in nameplate charge of R-404A

Options: KVS

- **K**it **V**ari-**S**mart
  - Ultra sonic ice level control
  - Add to a Prodigy Cuber, Flaker or Nugget ice maker
  - Mount sensor in socket in base
  - Mount control board onto existing controller
  - Adjust average maintained ice level from 9” to 32”

Other Options

- Smart-Boards – Universal
  - KSB**U**, KSB**U**-N, TPDL**2**
  - Works on all Prodigy Cubed, Nugget and Flaked ice machines
- Smart Lock – Remote lock out
- Side air flow kits
  - Add air filter to left side for specific applications
- Remote condenser air filter
  - KERCF for ERC111 and ERC311
- Baffle kit for BH900 applications
  - KBBF1

Summary

- Field proven ice making system
- Single 22” wide cabinet
- 23 and 27 inch tall cabinets
- External indicator lights
- Common layout
- Two ice forms
- Four basic capacity levels
- Air cooled, water cooled, remote air and remote low side