APPENDIX

SAMPLE FORMS

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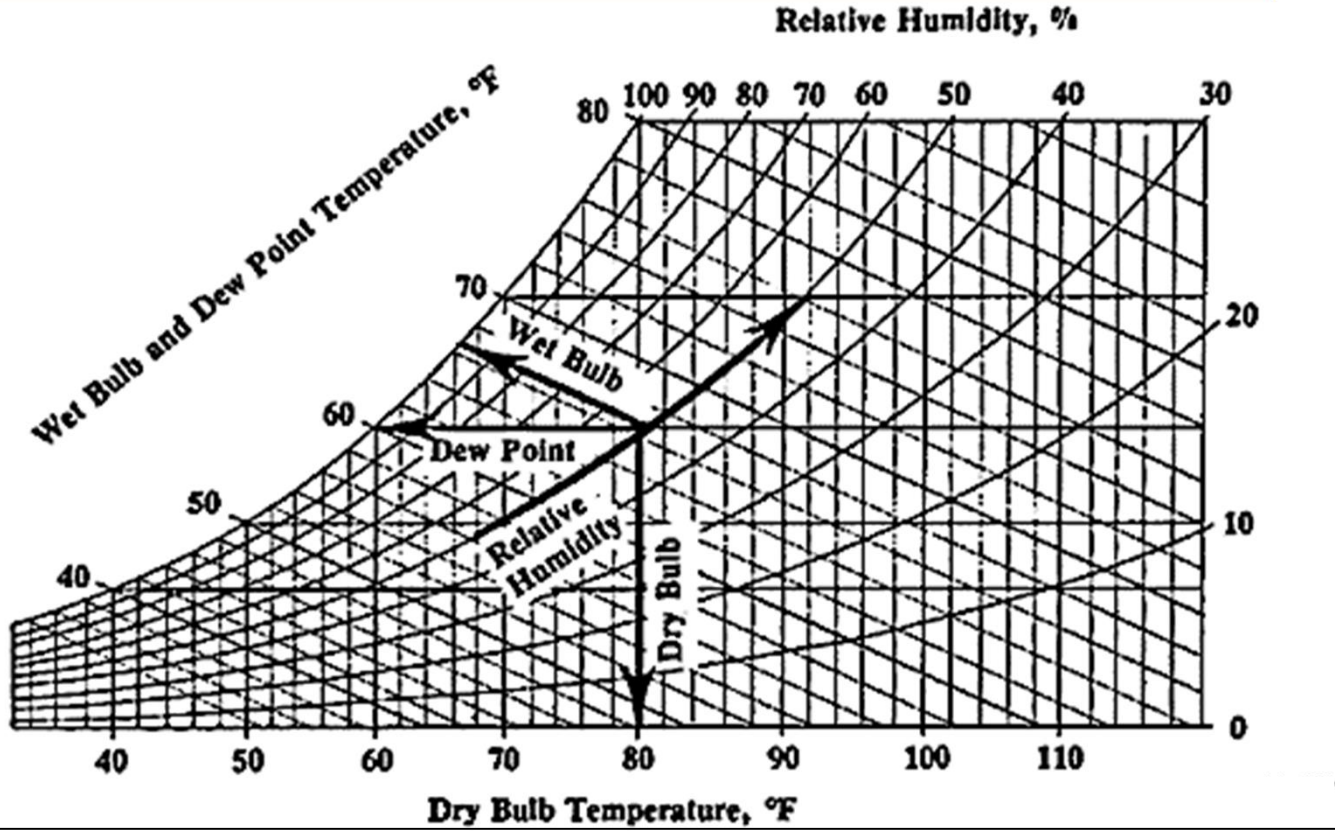
Appendix:
Inspection Forms-Sample

Item	Id#	Location	Date	Daily	Weekly	Monthly	Yearly	Inspection	Comments
Boilers	#1	Rm 6026	11-20-97	x				H2O level	ok
Boilers	#1-3	Rm 6026	11-21-97		x			treatment	ok
Boilers	#1-3	Rm 6026	11-21-97			x		combustion	ok
Furnaces	#8	Penthse	12-2-97			x		Filters	ok
Heating Coils	*68	Rm 5050	12-3-97				x	Clean	done

Appendix:
Inspection Forms

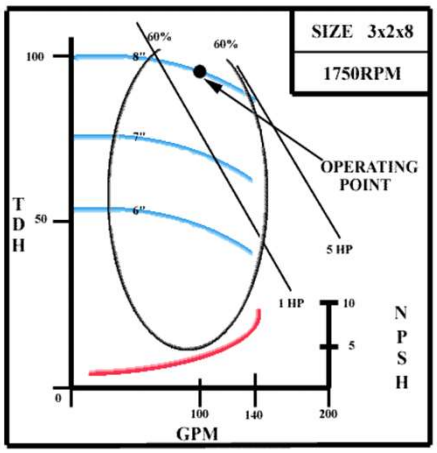
Item	Id#	Location	Date	Daily	Monthly	Qtr	Yearly	Inspection	Comments

Psychrometric Chart



Pump Curves Provide Pump Characteristics Unique for Each Pump to Determine Actual System Performance Including:

TDH, GPM, Hp, NPSH, Efficiency, Impeller Size



TDH = Total Feet of Head

GPM = Gallons per Minute of flow through the pump

Hp = Horsepower

NPSH = Net Positive Suction Head, which is the minimum pressure that the pump must maintain to avoid cavitation.

Efficiency = Power Output/Power Input

Impeller Size (will vary for each pump and application)

Other Useful Pump Formulas

- Pressure (PSI) = $\frac{\text{Head (feet) x Specific Gravity}}{2.31}$
- Head (feet) = $\frac{\text{Pressure (psi) x 2.31}}{\text{Specific Gravity}}$
- Horsepower (water) = $\frac{\text{GPM x Head x S.G.}}{3960}$
- Horsepower (brake) = $\frac{\text{GPM x Head x S.G.}}{3960 \times \text{Pump Efficiency}}$
- Efficiency (pump) = $\frac{\text{Horsepower (water)}}{\text{Horsepower (brake)}} \times 100\%$
- NPSH (Net Positive Suction Head, available from mfg) = Positive Factors – Negative Factors

Information and photos courtesy of Grundfoss and Bell and Gossett Pumps

Important Issues and Questions to Help Your CMMS Search

Work Order

1. CMMS should produce an easy-to-use work order that classifies all work by some kind of repair reason code: PM, corrective, breakdown, management decision, etc.
2. Provides an easy way for a single person or designated group in maintenance to screen work orders entered by customers before authorization that work can begin.
3. Prints up-to-date lockout procedure on all work orders automatically.
4. Automatically costs work orders.
5. Provides status of all outstanding work orders.
6. Records service calls (who, what, when, where, how) which can be printed in a log format with automated time/date stamping.
7. Allows operations people, tenants or facility users to have access to the system.
8. Records backlog of work and displays it by craft.
9. Work orders can be displayed or printed very easily.
10. The system facilitates labor scheduling with labor standards by task, ability to sort, and re-sort the open work orders by location of work, craft and other ways.
11. Records changes to inventory (receipts, chargeouts, physical inventories).
12. Does the system recommend stock levels, order points, order quantities?

Maintenance History and Reporting

13. Maintains maintenance history that is detailed enough to tell what happened.
14. Provides information to track the service request-maintenance work order issue-work complete-customer satisfied cycle.
15. Provides reports for budgets, staffing analysis, program evaluation, performance.
16. Is able to isolate all work done (sort, arrange, analyze, select, or list) by work order, mechanic, asset, building, floor, room, type of equipment or asset.
17. Provides the ability to easily structure ad hoc (on the spur of the moment) reports to answer questions that come up. This is sometimes called a report writer.
18. Has the ability to generate equipment/asset history from birth (installation, construction, or connection) with all major repairs and summaries of smaller repairs.

PM System

19. Automatically produces PM work orders on the right day, right meter reading etc.
20. Is able to display work load for PM for a future period such as a year by week or month by trade.
21. Is able to record short repairs done by PM mechanic and actual time spent.
22. Does the system support multiple levels of PM on the same asset, does it reset the clock if the high level is done (if you do a yearly rebuild, does the monthly PM clock get reset?)?
23. PMs are generated by location by trade to facilitate efficient use of people and minimize travel.
24. Highlights situations where the PM activity is more expensive than the breakdown.

General

25. Is easy to use for novices and quick to use for power users.
26. System is integrated or can be integrated to purchasing, engineering, payroll/accounting.
27. Does the vendor have software support staff and can you easily get through to a person? Is there an 800 number?
28. System runs on standard computer hardware, not some special hardware incompatible with everything else.
29. Is the system compatible with Local Area Networks if it is a PC product?
30. Has the vendor been in business for several years?

(Sample-Cleaver Brooks Boiler PM Sheet)

Table 1: Recommended Boiler Inspection Schedule (Steam and Hot Water)

Daily *	Weekly	Monthly	Semi-Annually	Annually
Check water level	Check for tight closing of fuel valves	Inspect burner	Clean low water cutoff (s)	Clean fireside surfaces
Blowdown boiler	Check fuel and air linkage	Analyze combustion	Check oil preheater	Clean breeching
Blowdown water column	Check indicating lights and alarms	Check cams	Inspect refractory	Clean waterside surfaces
Check combustion visually	Check operating and limit controls	Inspect for flue gas leaks	Clean oil pump strainer and filter	Check oil storage tanks
Treat water according to the established program	Check safety and interlock controls	Inspect for hot spots	Clean air cleaner and air/oil separator	Check fluid levels on hydraulic valves
Record boiler operating pressure/ temperature.	Check low water cutoff(s) operation	Review boiler blowdown procedures	Check pump coupling alinement	Check gauge glass
Record feedwater pressure/ temperature	Check for leaks, noise, vibration, unusual conditions, etc.	Check combustion air supply	Reset combustion	Remove and recondition safety valves
Record flue gas temperature	Check operation of all motors	Check all filter elements	Inspect mercury switches	Check oil pumps
Record oil pressure and temperature	Check general burner operation	Check fuel systems		Check boiler feed pumps
Record gas pressure	Check lubricating oil levels	Check belt drives		Check condensate receivers
Record atomizing pressure	Check flame scanner assembly	Check lubrication requirements		Check chemical feed systems
Check general boiler/burner operation	Check packing glands			Tighten all electrical terminals
Record boiler water supply and return temperature	Check gauge glass			Check deaerator/ boiler feed system
Record makeup water usage				Check Linkages
Check operation of auxiliary equipment				

* Daily items may be done more than once per day.

(Sample-York Compressor Control Panel Troubleshooting Sheet)

SECTION 8
TROUBLESHOOTING

The following procedures are designed to guide the service technician along the path that leads to the identification of the cause of the problem. The service technician should understand the operation of the Liquid Cooled Solid State Starter and function of each major component and PC board. It is recommended that the service technician read and understand the information contained in this instruction prior to troubleshooting this product. Also, the service technician must understand the system interface, and be able to utilize system wiring diagrams to follow signal flow throughout the system. Due to the integration of the Liquid Cooled Solid State Starter with the MicroComputer Control Center, a knowledge of the MicroComputer Control Center is also necessary (Ref. Form listed on Page 2).

Several levels of documentation are required for the troubleshooting process. The Liquid Cooled Solid State Starter wiring diagram, supplied with every starter is the top level document. It provides the overall wiring and configuration. Sections of this instruction provide the required lower levels, Specifically, block diagrams provide signal flow and simplified representations of PC board circuitry. The "Inputs and Outputs" of each board provide details of the required voltage levels at all connectors on the PC boards.

The following are the major categories of problems included in the troubleshooting procedures:

- Starting Problem.
- Overload (while running).
- Overload (while starting).
- Power Fault.
- OOL.
- ØROT/LOSS.
- High Temp.
- Cooling Loop and Water Pump.
- Motor Current Display.
- AC Power Line Voltage Display.
- Half Phase.

Begin the troubleshooting process by selecting the appropriate procedure. It is not necessary to sequentially perform all of them. Perform a procedure only if there is a problem with that function.

REPLACING AN SCR ASSEMBLY

If it becomes necessary to replace an SCR, the entire SCR heatsink assembly must be replaced. SCR's are not individually replaceable.

SECTIO 6

Early vintage starters (7L, 14L, 26L, 33L, - P/N 371-01071/01072-XXX) were supplied with SCR assemblies P/N 371-01085-XXX or 371-01106-XXX.

SECTIO 7

Style "A" starters (7L-A, 14L-A, 26L-A, 33L-A - P/N 371-01210-01211-XXX) and (26LK-A, 33LK-A - P/N 371-01237-XXX) are supplied with SCR assemblies P/N 371-01184-XXX or 371-01185-XXX. For service replacement purposes, these SCR assemblies are supplied as part of a kit (P/N 375-03048-XXX) (Ref. 160.46-RP1 (Sect. 4) that contains the necessary ancillary items used in SCR assembly replacement. These kits also contain items that allow the Style "A" SCR assemblies to be installed in the early vintage starters. (7L, 14L, 26L, 33L - P/N 371-01071-01072-XXX). The Style "A" SCR assemblies will eventually replace early vintage SCR assemblies for service replacement purposes.

SECTIO 8

> Refer to Replacement Parts List Form 160.46-RP1 (Sect.4) for replacement SCR assembly kit part numbers.

INSTALLING SCR ASSEMBLIES (371-01085-XXX or 371-01106-XXX) IN EARLY VINTAGE STARTERS (371-01071-XXX or 371-01072-XXX). (7L, 14L, 26L, 33L):

1. Remove AC power from system.
2. Drain water from cooling loop.
3. Loosen both water header connections to the defective heatsink assembly.
4. Remove all connections to Trigger Board. Remove Trigger Board assembly by removing 4 panel mounting screws.
5. Remove all electrical connections.
6. Remove current transformer from mounting studs and fold out of the way. Remove electrical connections if necessary.
7. Remove the four SCR/heatsink assembly mounting nuts from the mounting studs and remove the entire SCR/Heatsink assembly.
8. Place the defective assembly on a work surface and remove the capacitor assembly, resistor assembly and water connections (2).
9. Install the parts removed in step #8 to the new assembly. Refer to Fig.'s 15, 16 and 17.
10. Install the new SCR/heatsink assembly in the starter and install the water and electrical connections.
11. Install Current Transformer, Trigger Board and make all necessary electrical connections.
12. Fill cooling loop with water per COOLING LOOP FILL INSTRUCTIONS in Section 5.

> In the following procedures, item numbers refer to items supplied in SCR assembly replacement kits as detailed in Table 2. Refer to YORK Form 160.46-RP1 (Sect. 4) for SCR assembly replacement kit numbers. Do not order individual parts. Order kits only.

(Sample-York AHU Fan System Troubleshooting Chart)

TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSE — SOLUTIONS
DRIVE NOISE	Sheave(s) not tight on shaft(s) (motor or fan). Tighten sheave(s).
	Belts hitting belt guard. Adjust or tighten belt guard mounts.
	Belts loose. Adjust to proper tension. Belts should be checked twice during first days operation and periodically thereafter.
	Belts too tight. Adjust to proper tension.
	Belts are wrong cross section to fit sheaves. Install proper belts.
	Belts not matched in length on multi-belt drive. Install matched belts.
	Misaligned sheaves. Align sheaves properly.
	Belts worn. Replace belts.
	Motor, motor base or fan not securely anchored. Anchor loose components as required.
	Belts oily or dirty. Clean or replace belts.
BEARING NOISE	Defective bearing. Repair or replace bearing.
	Bearing needs lubrication. Lubricate bearing as required.
	Bearing loose on bearing support. Tighten bearing support bolts.
	Bearing loose on shaft. Tighten bearing to shaft.
	Bearing misaligned (check alignment binding.) Align properly.
	Foreign material inside bearing. Disassemble, inspect and clean or replace bearing as required.
	Fretting corrosion between bearing inner race and shaft. Clean or replace bearing as required.
HIGH VELOCITY AIR NOISE	Ductwork too small. Increase duct sizes to obtain proper air velocity.
	Fan running too fast. Check for proper fan RPM.
	Static pressure lower than expected. Reduce fan speed to obtain desired flow rate.
	Registers and grilles too small. Install correct registers and grilles as required.
RATTLE OR WHISTLING NOISE IN AIR STREAM	Dampers obstructed. Remove obstruction.
	Diffusers obstructed. Remove obstruction.
	Loose dampers or splitters. Tighten as required.
	Loose grilles. Tighten grilles as required.
	Sharp elbow(s). Install elbow(s) with larger turning radius.
	Sudden expansion or contraction of ductwork. Install proper ductwork transitions.
	Turning vanes loose or not properly installed. Tighten and / or re-install as required.
CFM LOWER THAN REQUIRED	Fan wheel installed backwards. Install in correct position.
	Fan wheel rotating backwards. Reverse any two power leads to fan, to change rotation.
	Fan wheel not centered in inlet cones. Re-align fan to center of inlet cones.
	Fan speed too slow. Check for proper fan RPM.
	Actual duct system has more resistance to flow than originally designed. Enlarge ductwork or remove restrictions to match design requirements.
	Dampers closed and / or splitter rod disconnected. Open dampers and connect splitter rod.
	Registers closed. Open registers.