hydro THERMAL®

Industrial Starch Cooking System
Troubleshooting Guide

Who Should Use This Troubleshooting Guide?

With more than 100 industrial starch cooking systems operating in facilities around the country, our industry experts know starch cooking. Often times, apparent issues with heater operation are the result of a problem or adverse condition in the steam supply system, product supply, or inadequate component maintenance. To help you evaluate your overall system, our experts have prepared this Troubleshooting Guide.

The following pages are to guide technical personnel through a logical approach for industrial starch cooking system troubleshooting. General problems are shown above each table. Observations of the problem are listed in the *Issue* column, and the *System Check* indicated in the next column, are the suggested operations that will likely resolve the issue.

If you are not able to solve a problem with your industrial starch cooking system as described in these pages, or the problem is not covered, please contact Hydro-Thermal at 800-952-0121 or by email at info@hydro-thermal.com.

Issues Discussed in this Troubleshooting Guide

Use this Guide as your first step in diagnosing where your system might be lagging – including these five key areas:

1. Quality Issues
2. Cook Temperature Issues
3. Hammering and Vibration
4. Process Pressure Issues
5. Starch System Capacity Bottleneck

Learn more at:
Go to www.hydro-thermal.com or
Contact us at info@hydro-thermal.com

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1. Starch Quality Issues

1.1 Issues with Starch Viscosity

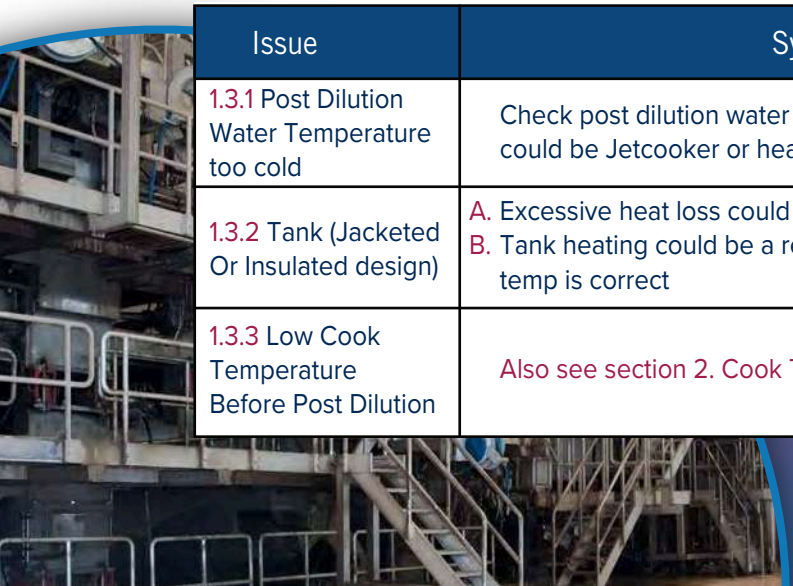
Issue	System Check
1.1.1 Fluctuation In Cook Temperature	A. Do you have fluctuations in steam pressure or supply (see section 2.4) B. Check/calibrate temperature element C. Is there variation in system back pressure (see section 2.3) D. Refer to Jetcooker sizing for expected heater percent opening and confirm proper actuator/positioner calibration E. Is there consistent process flow
1.1.2 Uncooked Starch	A. Can you achieve correct cook temperature (see section 2) B. Is back pressure high enough to prevent flashing at Jetcooker (see section 2.3A) C. Was there a change in type of starch being cooked D. Retention time in hold tube may be too short. Have you changed production rates through the system
1.1.3 Percentage Of Cook Solids	Also see section 1.2 Percentage of Cook Solids

1.2 Issues in % Cook Solids

Issue	System Check
1.2.1 Starch Slurry Make Down System	A. Confirm % make down solids B. Is correct recipe programmed, or has the make down consistency changed C. Is starch mixed properly, or agitator having problems D. Is there inconsistent dry starch feed rate occurring E. Check for correct water supply total in make down tank
1.2.2 Pre-cook Dilution Problem	A. Is correct recipe programmed, or has the dilution rate been changed B. Check flow control valve and flow meter if automated system C. Confirm dilution flow rate and make adjustment if needed.
1.2.3 Cooked Starch Slurry Dilution Problem	A. Is correct recipe programmed, or has the dilution rate been changed B. Check flow control valve and flow meter on post dilution line C. Confirm post dilution flow rate and make adjustment if needed (Note: post dilution compensated for by condensate addition through Jetcooker)

1.3 Issues with Storage Tank Temperature

Issue	System Check
1.3.1 Post Dilution Water Temperature too cold	Check post dilution water temperature or has a heating source failed (heater could be Jetcooker or heat exchanger)
1.3.2 Tank (Jacketed Or Insulated design)	A. Excessive heat loss could be from removal of insulation or tank lid B. Tank heating could be a result of failure of steam/water jacket, ensure jacket temp is correct
1.3.3 Low Cook Temperature Before Post Dilution	Also see section 2. Cook Temperature



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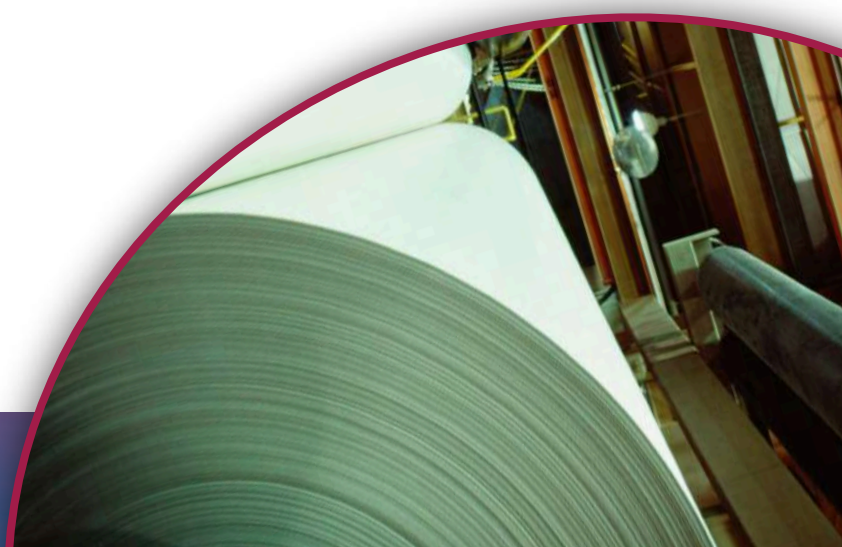
2. Cook Temperature Issue

Issue	System Check
2.1 Temperature Sensor Calibration	A. Check/calibrate temperature element B. Confirm temperature at end of hold tube section and compare to calibrated temperature readings C. Refer to Jetcooker sizing for expected heater percent opening and confirm proper actuator/positioner calibration
2.2 Temperature Swings	A. Do you have variations in steam pressure or supply B. Is there consistent process flow C. Is there variation in system back pressure (see section 2.3) D. Do you have steam surging – improper steam mixing inside heater can cause surging of slurry flow. Contact Hydro-Thermal for proper heater operation
2.3 System Back Pressure At Heater Discharge	A. Back pressure too low results in flashing below desired cook temperature. Check back pressure valve for either failure or incorrect setting B. Back pressure too high violating choked flow conditions resulting in instability or reduced Jetcooker steam capacity. Consult Hydro-Thermal for details on correct pressure ratio.
2.4 Low Steam Pressure	A. Is the Jetcooker operating at 100% open resulting in not achieving set point temperature, steam pressure is too low B. Confirm steam pressure at Jetcooker inlet piping C. Has steam supply or steam pressure been changed to the starch system D. Also see section 2.3B
2.5 Control System Settings Or Communication	A. Confirm recipe matches process conditions B. Check Jetcooker PID settings, check to see if temperature sensor is providing proper feedback
2.6 Current Process Flow Exceeds Heater Capacity	A. Confirm recipe matches process conditions B. Confirm slurry make down % solids, if make down % is low the flowrate to Jetcooker will be too high. Refer to heater sizing to confirm design conditions



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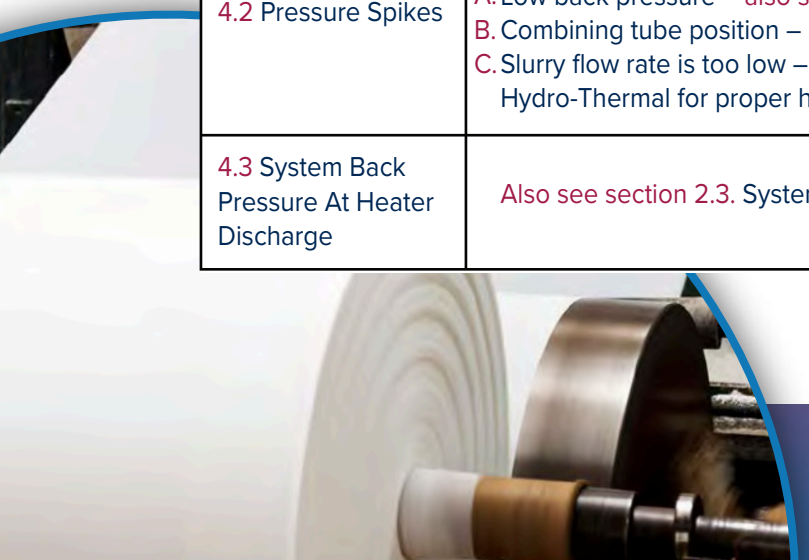
3. Hammering and Vibration

Issue	System Check
3.1 Change In Process Conditions Outside Design Criteria	Jetcooker is configured to operate within a specific range of process conditions. Consult original heater sizing and contact Hydro-Thermal for proper heater operation
3.2 Combining Tube Adjustment	The Combining tube position could be affecting steam mixing with the starch slurry. Consult Jetcooker manual or contact Hydro- Thermal with questions prior to adjusting combining tube position.
3.3 Worn Internals	Worn internals can affect steam control and mixing ability. Contact Hydro-Thermal for recommended parts and maintenance schedule.
3.4 System Back Pressure At Heater Discharge	Also see section 2.3 System back pressure at heater discharge
3.5 Wet Steam	Check steam trap and drip leg to ensure clean dry steam.

4. Process Pressure Issues

Issue	System Check
4.1 Excessive System Pressure Drop/ High Supply Pressure (Safety Relief Valve Venting/ Dumping Slurry)	A. Starch strainer is clogged. Clean or replace basket to reduce pressure drop across strainer B. Combining tube position is too closed for current flow rate. Consult Jetcooker manual or contact Hydro-Thermal with questions prior to adjusting combining tube position C. Possible cooked starch build-up plugging the discharge piping and hold tube. Confirm proper flush cycle operation D. Ensure back pressure valve is maintaining proper hold tube back pressure
4.2 Pressure Spikes	Can be a result of inconsistent steam flow and surging A. Low back pressure – also see section 2.3A B. Combining tube position – also see section 3.2 C. Slurry flow rate is too low – Consult original heater sizing and contact Hydro-Thermal for proper heater operation
4.3 System Back Pressure At Heater Discharge	Also see section 2.3. System back pressure at heater discharge



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5. Starch System Capacity Bottleneck

Issue	System Check
5.1 System Running 100% Of The Time	Production demand exceeds original system capacity requirements. Consult original heater sizing and contact Hydro-Thermal for proper heater operation
5.2 Too Long Of A Warm Up And Flush Cycle	Review warm up and flush cycle system settings. Refer to system manual and functional description for recommended cycle times
5.3 Improper Make Down And Cooking Solids	Make down or cooker feed solids too low resulting in high cooker flow rates
5.4 Improper Flow Measurements	Check calibration of flow meters and ensure proper slurry dilution rates

OPTIMIZE YOUR PAPER PRODUCTION OPERATIONS WITH HYDRO-THERMAL

Our complete starch cooking systems are fully integrated from make down to storage. Featuring the genuine Jetcooker™ – the industry standard for starch cooking – our systems deliver instantaneous gelatinization of starch with adjustable shear and precise temperature control. It's simply the most complete and reliable starch cooking system available – backed by a 100% performance guarantee.

ABOUT HYDRO-THERMAL CORPORATION

Hydro-Thermal Corporation (HTC) provides world-class energy-efficient direct steam injection heating systems, enabling precise (+/- 1° F) heating of water and process fluids, on demand. Clients in over 86 countries have installed Hydroheaters to replace heat exchangers and spargers, to heat water through viscous slurries, in a broad array of applications, including water heating, starch cooking, pulp stock heating, black/green/white liquor heating, jacketed reactor heating, CIP systems, and wastewater & industrial pretreatment heating. Save energy, time, space, maintenance and improve product quality with HTC.

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