

Thermal Oil Boil-out: Principles and Startup Observations

English adaptation of original JIELI technical notes · September 21, 2026

JIELI ORIGINAL TECHNICAL NOTES · UPDATED SEPTEMBER 21, 2026

Thermal oil boil-out: what pressure, pump noise and tank level can tell you

These notes are an English adaptation of JIELI's original Chinese technical paper, *Zhu You de Zhi Shi He Guo Cheng* (Thermal Oil Boil-out: Principles and Process). They explain the relationship between cold circulation, entrained air, residual water, pump suction and staged heating. In this context, **thermal oil boil-out** means controlled dehydration and degassing of a thermal-fluid system; it does not mean deliberately boiling the heat-transfer oil.

The practical focus is to read several signals together: circulation, pressure trend, pump sound, expansion-tank level and vent behavior. A quiet pressure gauge alone does not establish adequate flow or authorize firing.

1. Cold oil, entrained air and dispersed water

Cold thermal oil is generally more viscous than the same fluid at operating temperature. Where residual air or water is present, pump shear can disperse gas bubbles or water droplets through the oil. The source paper describes this mixed condition as “emulsification.” More precisely, entrained air forms a gas–liquid dispersion; water droplets dispersed in oil can form an oil–water emulsion. They are related startup problems, but they are not the same physical state, and neither is inevitable in a properly dried and vented system.

Higher viscosity can slow bubble separation. Gentle warming can help gas separate and allow residual water to vaporize, once adequate circulation and all firing permissives have been proved. The actual behavior depends on the fluid, bubble size, pressure, piping and vent arrangement.

2. Why the cold pressure reading may be low

The source notes describe a pressure gauge changing from wide swings to a steadier, lower reading during cold circulation. Entrained gas can impair a centrifugal pump's delivery, while cold-fluid viscosity and suction losses also affect the operating point. A lower or steadier gauge reading is therefore an observation to investigate, not a universal pass criterion.

Compare pump suction and discharge pressure, differential pressure, measured or proved flow, motor current, tank level and the pump curve at the actual fluid temperature. Distinguish normal *operating pressure* from the equipment's *design pressure*: startup does not require the gauge to reach the design-pressure rating.

3. Heating and dehydration must be coordinated

The source paper emphasizes that circulation alone may not remove finely dispersed moisture. Heating changes viscosity and promotes moisture release, but water expanding into steam can interrupt flow or eject hot oil if heat input exceeds the system's ability to separate and remove vapor. The temperature measured in the bulk fluid can also differ from the temperature beside a heated surface.

Use the approved vapor-separation and collection route. An open expansion tank, a closed pressurized tank and a nitrogen-blanketed system require different arrangements; do not assume that vapor should discharge directly to the

atmosphere.

4. Expansion-tank level supports reliable pump suction

In an elevated-tank arrangement, the liquid column helps establish static head at the pump suction. The source paper highlights what happens when the level falls far enough to admit air or lose this liquid connection: circulation can become unstable and the pump can lose prime. Static head, suction-pipe losses and vapor pressure must be considered together.

Low level, loss of flow, violent pressure fluctuations or metallic pump noise are abnormal conditions. Stop heat input and follow the approved safe-shutdown and pump-protection sequence. Do not keep firing through severe cavitation, run an unfilled pump or add water to the oil system.

SOURCE EXAMPLE · OBSERVATION POINTS

A 280°C thermal oil system: staged dehydration observations

The following temperature points come from JIELI's original notes for a system intended to operate at 280°C. They are an **example for engineering review, not universal setpoints or a standalone operating procedure**. Select the actual ramp, hold points and release criteria from the installed equipment, fluid supplier's instructions, moisture condition and approved commissioning plan.

Source temperature point	What the notes highlight	How to assess the condition
Cold circulation, before the approach to 90°C	Establish continuous oil circulation before introducing heat. The source groups this with the initial approach to 90°C.	The system and pump must already be filled with oil. Circulate with the heater off first; do not interpret “dry circulation” as running the pump dry. Prove the required flow and firing permissives before controlled heating begins.
Around 95°C	An early observation point for thermal inertia, initial vapor release and pressure changes.	A heated surface may be hotter than the bulk reading. The responsible commissioning team controls heat input under the approved plan. Vapor or smoke is not automatically evidence of successful moisture removal.
Approximately 105–130°C	The source describes a main moisture-release stage, with a risk of surging and expansion-tank overflow.	Monitor flow, level, pressure and the designed vapor-removal route. Severe cavitation, violent gauge movement or loss of circulation require heat shutdown and investigation; they are not acceptable targets to maintain.
Around 130°C	A checkpoint for restored stable circulation and reduced vapor release.	Stable flow, normal pump behavior, appropriate operating pressures and the approved moisture-release criteria must agree. Reaching 130°C does not prove that every part of the system is dry.
Approximately 130–210°C	The source proposes a subsequent rise of 10–20°C per hour after dehydration is verified.	This is the source example's ramp range, subject to fluid and equipment approval. Change temporary vent valve positions only under the approved P&ID and procedure; keep all required expansion, relief and safety paths available.
Approximately 210–230°C	A second observation stage; the source suggests a 1–2 hour hold if the fluid behavior requires it.	Investigate any renewed gas evolution with the fluid supplier. Its composition cannot be identified from temperature alone, and this range is not a universal boiling threshold for “heavy components.”

Source temperature point	What the notes highlight	How to assess the condition
280°C in this example	The intended operating condition and transition to controlled process loading.	Proceed only within the approved bulk and film-temperature limits, with circulation and safeguards proved. Record supply/return temperature, flow, pressure drop and tank level; 280°C is not the operating target for every thermal oil system.

What “dehydration complete” means: meet the written acceptance criteria for the whole circuit, including remote branches and process users. Temperature and visible venting alone cannot exclude trapped water. If significant water contamination is suspected, obtain specialist instructions before further heating.

Record the evidence at each startup hold point

A useful commissioning record connects the time and fluid temperature to suction/discharge pressure, flow proof, pump current, tank level, vent observations and the person authorizing the next stage. Keep the readings with the approved P&ID, fluid data sheet and protection-test results.

[Download the blank thermal oil startup observation log \(CSV\)](#) · [Download these English technical notes \(PDF\)](#)

For system selection, see the [thermal oil heater range](#). For related design checks, review [expansion-tank sizing](#), [circulation-pump selection](#) and [thermal oil flow and pipe sizing](#).

Reference and scope

These notes supplement the approved heater and fluid-supplier procedures. For general moisture-removal guidance, see [Eastman Therminol technical resources](#). That external reference does not validate the temperature points in the JIELI example.

[Read the complete startup, venting and dehydration guide online](#)