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1.1 Executive summary

SAM's 2026 Steam School curriculum and SOPEEC's 2018 Special Steam-Powered Traction Engine syllabus are **strongly aligned at the topic level**: both cover boiler types and construction, thermodynamics, water treatment, engine operation, safety, emergency procedures, inspection, and repairs.

SAM goes **much deeper into practical, hands-on operation** (startup routines, belting, maneuvering, detailed lubrication, crew preparation, logbook practice, history), while SOPEEC adds **exam-oriented abstractions and regulatory formalisms** (CRN, formal NDE methods, heating surface calculations, indicator diagrams, explicit certification constructs).

Overall: SAM provides a **practical training program** that substantially prepares a candidate for the SOPEEC exam, but there are a few **SOPEEC-only conceptual gaps** that should be explicitly addressed if "full coverage" is the goal.

1.2 Intersection (covered by both)

1.2.1 Legislation, certification, and records

- Governing Act and Regulations
 - SAM: "Boiler Law and Regulations" (2.18) — ASME, NBIC, CSA, Manitoba Act and ITS Manitoba.
 - SOPEEC: "Act and Regulation applicable sections of the governing jurisdiction" (1.0(a)).
- Codes and standards (ASME, CSA, NBIC)
 - SAM: 2.18 references ASME, NBIC Parts 2 & 3, CSA, Manitoba legislation.
 - SOPEEC: 1.0(b–d), 1.6(h), 1.12(a–c) reference CSA B51, ASME Section I/VII, NBIC.
- Operator certification and permits
 - SAM: 1.2 Licensing Requirements; 2.17 Log Books.
 - SOPEEC: 1.0(h–i), 1.7(l–m) — operator certification, certificate of inspection permit, log book.

1.2.2 Thermodynamics and properties of steam

- Temperature, heat, BTU, sensible/latent heat, vaporization
 - SAM: 2.2 "Properties of Water and Steam" — BTU, latent heat of vaporization, wet/dry/superheated steam.
 - SOPEEC: 1.4(a–g, j) — temperature, BTU/kW, sensible/latent heat, vaporization, steam states.
- Pressure and its effects
 - SAM: 2.2 — atmospheric pressure, gauge pressure, venturi, temperature–pressure relation, expansive properties.
 - SOPEEC: 1.4(h), 1.3(a) — pressure, conversions, effects.

1.2.3 Boilers, construction, and components

- Boiler types (fired tube, watertube, locomotive, vertical)
 - SAM: 2.3.1 "Types of Boilers" — fire tube, vertical, return flue, locomotive, water tube.
 - SOPEEC: 1.5(a–d) — fired tube, watertube, locomotive type, vertical.
- Boiler parts and terminology
 - SAM: 2.3.3 — firebox, barrel, smoke box, tube sheets, crown sheet, mud ring, stays, hand holes, grates, dampers, etc.
 - SOPEEC: 1.5(f–g) — shell, tubes, heads, stays, fusible plug, firebox, smokebox, tubesheet, crown sheet, mudring, grates, ash pan, dampers.
- Auxiliary components and safety devices
 - SAM: 2.3.2 and 2.4.1/2.4.2 — water gauge glass, water column, try cocks, steam pressure gauge, safety valves, fusible plug, injectors, feedwater pumps, blowdown

- valve, whistle, dome valve, blower.
- SOPEEC: 1.5(h), 1.7(a) — safety valve(s), steam pressure gauge, water level indicator, gauge glass, water column, try cocks, blowoff valve, throttle, governor, feedwater pump/injector, pressure relief device, whistle.

1.2.4 Inspection, testing, and MAWP

- Internal/external inspection and preparation
 - SAM: 2.15 "Inspection" — visual/internal, hydrostatic, operational exam, preparation, MAWP determination.
 - SOPEEC: 1.6(e–f, i–l) — boiler cleaning and preparation, visual internal/external, causes of deterioration, stay and weld inspection.
- Hydrostatic testing and test conditions
 - SAM: 2.15 — hydrostatic testing, water temperature, pressure level.
 - SOPEEC: 1.8(a–d) — hydro testing, test pressure, water temperature.
- MAWP determination
 - SAM: 2.15 — "Determination of maximum allowable working pressure (MAWP)".
 - SOPEEC: 1.0(d), 1.5(g), 1.6(h) — process for determining MAWP using CSA B51 and NBIC.

1.2.5 Operation, firing, and handling

- Startup and shutdown procedures
 - SAM: 2.8 "Startup Routine Procedures", 2.14 "Shutdown" — crew preparation, water checks, valve settings, blowdown, lay-up.
 - SOPEEC: 1.7(b–c, d, f) — boiler startup, shutdown, bottom blowoff, layup and storage.
- Firing and combustion
 - SAM: 2.10 "Firing" — fuel types (wood, coal, straw, oil), draft, arches, dampers, banking, back draft.
 - SOPEEC: 1.7(n) — principles of combustion, fuel types, draft systems, soot, ash, clinkers, furnace explosions.
- Engine operation and control
 - SAM: 2.7.3–2.7.4, 2.11–2.12 — engine components, throttle, governor, valve gear, dead centres, handling, belting, driving, braking without brakes.
 - SOPEEC: 1.7(h, j, k), 1.10(a–m), 1.7(o–t) — throttle and governor operation, water hammer, removing condensate, driving, hills and grades, powering stationary loads.

1.2.6 Water treatment and corrosion

- Water treatment purpose and chemistry
 - SAM: 2.6 "Boiler Water Treatment" — oxygen, minerals, pH, foaming, priming, blowdown, test kits, oxygen scavengers.
 - SOPEEC: 1.9(a–n) — dissolved gases/solids, pH control, scale, sludge, foaming, oil in water, acidic attack, water testing, oxygen scavenger, selecting and handling treatment programs.
- Corrosion and deterioration
 - SAM: 2.6 (oxygen, pitting, necking), 2.15 (causes of deterioration implied).
 - SOPEEC: 1.0(m), 1.6(i) — causes of corrosion and deterioration.

1.2.7 Safety and emergency procedures

- Low/high water, broken gauge glass, piping failures, safety valve issues
 - SAM: 2.13 "Emergency Procedures" — water glass breaks, runaway engine, injector trouble, foaming/priming, hand hole gasket blows, tube bursts, leaking valve/pipe/plug, safety valve problems.
 - SOPEEC: 1.2(a–j), 1.11(a–h) — low/high water, broken gauge glass, piping failure, safety valve stuck, fusible plug activation, tube rupture, boiler explosions.
- Driving and public demonstration safety
 - SAM: 2.11–2.12 — handling engine, maneuvering, parading, parking.

- SOPEEC: 1.2(k-r), 1.7(o-r) — driving on grades, driving in public demonstration, braking, burns, cuts, sparks, PPE.

1.2.8 Repairs and QA

- Repairs and modifications under QA
 - SAM: 2.16 “Repairs and Modifications” — SAM QA program, repair plans, approval, certification of service providers, pre/post-repair inspection.
 - SOPEEC: 1.12(a-e) — standards for repairs (CSA B51, NBIC, ASME), jurisdictional requirements, inspection and certification, quality control program.
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1.3 SAM-only (not explicitly in SOPEEC)

1.3.1 Strongly practical, hands-on training elements

- Detailed hands-on task list for candidates (1.3)
 - Checking water in boiler and reservoir tanks, installing fusible plugs and hand holes, cleaning tubes and ash pan, lubricating the entire engine, bringing engine up from cold, proving gauge glass, operating try cocks, emergency shutdown, safe blowdown, draining and washing boiler, preparing for inspection.
- Crew preparation and daily routines (2.8.1–2.8.2)
 - Marking crown sheet level on back head, verifying try cock locations, clothing and tools, detailed water checks, hand hole cautions, valve operation techniques, safe disposal of hot ashes.
- Detailed belting, hitching, and maneuvering (2.12)
 - Crew duties while belting up and on the belt, connecting to pulled equipment, maneuvering close to objects, parading and parking.
- Fine-grained lubrication practice (2.9)
 - Specific lubricator types (hydrostatic, mechanical, sight glass, grease cups), bearing temperature checks (back of hand, IR thermometer).
- Detailed component-level nomenclature for traction engines (2.7.3)
 - Extensive list of engine parts (crosshead shoes, wrist pins, clutch shoes/pins, etc.) beyond SOPEEC’s more compact list.
- Local historical and contextual content (3. History of Steam Traction Engine Development)
 - Technical developments, “Alberta or Canadian Boiler”, companies and mergers, features that worked/failed.

1.3.2 Manitoba-specific or SAM-specific structures

- SAM-specific licensing pathway and ITS affidavit (1.2).
 - SAM QA program for repairs (2.16).
 - Explicit reference to Manitoba Provincial Pressure Vessel Act and ITS Manitoba (2.18).
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1.4 SOPEEC-only (not explicitly in SAM)

1.4.1 Formal regulatory and registration constructs

- CRN (Canadian Registration Number) (1.0(e), 1.6(c)).
- Certificate of Inspection Permit as a formal construct (1.0(g), 1.6(d), 1.7(l)).
- Explicit “Registration” as a topic (1.0(f)).

1.4.2 Explicit NDE methods and detail

- Named NDE methods: UT, MPI, LPI, RT (1.6(g)).
- Using NDE results to determine MAWP by referencing CSA B51 and NBIC (1.6(h)).

1.4.3 Specific calculation topics

- Heating surface calculations (1.3(c)).
- Explicit conversion between Imperial and Metric units (1.3(a)).

1.4.4 Indicator diagrams and engine analysis

- Indicator diagrams (1.10(m)) — not present in SAM.

1.4.5 Some explicit abstract formulations

- “Thermal stress” as a named topic (1.5(q)).
- “Water hammer” as a named topic (1.7(i), 1.11(f)) — SAM covers the phenomenon implicitly via condensate and operation, but not by name.
- “Overspeed trip” as a specific device (1.5(h)) — SAM covers governor overspeed scenarios but not the overspeed trip as a separate device.