

Formula 1

Content placeholder

Formula 2

Content placeholder

Formula 3

Content placeholder

Detailed Explanation

Section 32 of NEMA MG-1-2023 establishes a unified framework for the application and sizing of motor-driven centrifugal and positive-displacement pumps in high-temperature TES systems—commonly deployed in concentrated solar power (CSP), industrial waste-heat recovery, and grid-scale thermal storage. Unlike general-purpose pump standards, it explicitly accounts for thermal expansion effects on pump casing and shaft seals, viscosity-temperature dependencies of heat-transfer fluids, and motor insulation class limitations under continuous ambient and fluid-side heating. A core principle is the requirement for thermal derating of both pump hydraulic efficiency and motor output capacity based on measured or modeled fluid inlet temperature, ambient enclosure temperature, and duty-cycle profile (e.g., intermittent vs. continuous circulation). The section mandates coordinated verification between pump manufacturer performance curves (corrected to actual fluid properties at operating temperature) and motor nameplate ratings (adjusted per IEEE 112 Method B or IEC 60034-1 thermal class allowances). Additionally, it prescribes minimum safety factors—including 15% margin on required system head and 10% margin on flow rate—to accommodate fouling, instrumentation uncertainty, and long-term degradation of thermal-fluid properties. Compliance ensures interoperability with ASME B31.1/B31.9 piping codes, NEC Article 430 motor circuit protection, and NFPA 85 boiler and combustion systems where applicable.

Key Components

#	Component
1	Thermal Derating Factors
2	Corrected Pump Performance Curves
3	Motor Insulation Class Verification

Applications

#	Application
1	Concentrated Solar Power (CSP) Molten Salt Circuits
2	Industrial Process Heat Recovery Loops
3	High-Temperature Phase-Change Material (PCM) Charging/Discharging Systems

Related Concepts

#	Concept
1	Thermal Fluid Rheology
2	Motor Insulation Thermal Class (e.g., Class H)
3	Pump Affinity Laws with Temperature Correction

Tags

thermal energy storage, pump sizing, high-temperature fluids, NEMA MG-1, motor derating

ToolFusion Engineering