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E-BOOK 04 PRACTITIONER EDITION

Pressure Switch & Pump Controller Field Manual

Cut-in / Cut-out Settings, Wiring, Auto-Start Logic and Failure Diagnosis

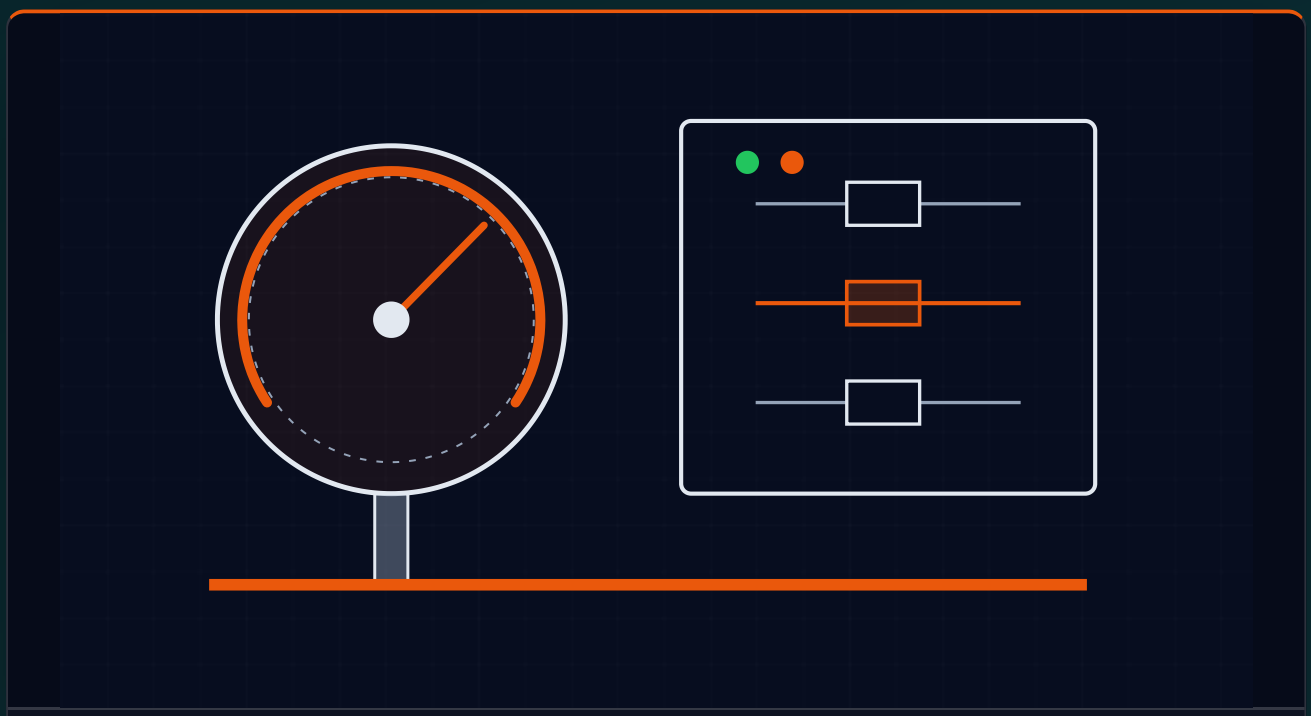


FIG 04.1 — PRESSURE SWITCH MANIFOLD & AUTO PUMP CONTROLLER LOGIC

SYLLABUS
10 Structured Chapters

CALCULATIONS
Worked SI Examples & Tables

SITE READY
Forms & Hinglish Glossary

Shree Ganesh Enterprises (SGE) — AMC MEP 24x7
Fire Fighting · Fire Alarm · Electrical · Plumbing · HVAC · IBMS · AMC

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Pressure Switch & Pump Controller Field Manual

Cut-in / Cut-out Settings, Wiring, Auto-Start Logic and Failure Diagnosis

A practitioner field manual focused on the fire system's most failure-prone link: the pressure-sensing loop, pressure switch range and differential calibration, cascaded Jockey/Main/Diesel controller wiring, chattering/hunting resolution, and step-by-step multimeter fault diagnosis.

Intended Audience: Fire electricians, pump-house technicians, commissioning engineers, and AMC maintenance teams fixing auto-start failures and jockey short-cycling.

Engineering Notice & Standards Policy

This publication is an educational and field-reference guide prepared by **Shree Ganesh Enterprises (SGE)**. It is **not** a substitute for a stamped project design, statutory approval, or the governing text of the National Building Code of India (NBC), Bureau of Indian Standards (BIS) codes, Indian Electricity Rules / CEA Regulations, or your State/Municipal Fire Service Bye-Laws. Standards are cited at document level; always verify the **current applicable edition**, manufacturer datasheets, and local amendments before design, procurement, testing, or certification.

Worked numerical examples across this book are illustrative engineering demonstrations. All design inputs, pipe friction factors, battery deratings, and protective clearances must be re-checked for project conditions by a competent licensed professional. High-voltage electrical testing, pump-room servicing, and gaseous fire suppression operations can be fatal if undertaken without qualified personnel, written Permits-to-Work, and Lockout-Tagout (LOTO) controls.

Roman-script Hindi/Hinglish site terms are included cleanly to assist execution teams; formal English engineering terminology governs contractual and code interpretations.

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What You Will Learn

- Trace every link in the pressure-sensing chain from main header to pump starter contactor coil
- Distinguish Range Spring vs Differential Spring adjustments and understand NO, NC, and COM terminals
- Calculate safe non-overlapping cascaded Cut-In and Cut-Out settings for Jockey, Main, and Diesel pumps
- Install air-cushioned sensing manifolds with isolation valves, test bleed cocks, and snubbers
- Read control panel Auto/Manual/Off wiring diagrams and verify contactor interlocks safely
- Diagnose jockey continuous running, switch chattering, and dead-start faults with systematic checklists

Chapter 1: Why One Failed Pressure Switch Cripples the Entire System

The Smallest Box Holds All the Authority

You can install a crore-rupee stainless-impeller split-case pump, massive RCC tanks, and a heavy steel wet riser —yet if a compact Rs 2,500 pressure switch fails on its impulse manifold, **not a single pump starts automatically when a fire breaks out**. Worse still, if a switch jams shut, a pump can run endlessly at churn pressure until shaft seals boil and motors burn out.

Every component between the header pipe and the motor starter is a single-point failure link unless installed, set, and tested properly.

The Pressure-Sensing Chain

Link	Component	Failure Mode Observed on Site	Prevention Measure
1	Header Tapping Point	Slag/rust plugs tiny hole on bottom of header	Tap cleanly from **top or side** of header; install isolation cock
2	Impulse Tube / Line	Crushed by ladders, or air-locked loop	Rigid heavy gauge tubing with mechanical guard + clean slope
3	Test Drain & Snubber Valve	No drain cock fitted -> impossible to test switch safely	Always install dedicated 3-way test/bleed manifold & pressure gauge
4	Pressure Switch Mechanism	Diaphragm ruptured or microswitch contact pitted/welded	Periodic full-drop test & replacement every few years per wear
5	Control Wiring & Contactor	Loose ferrule at terminal block, or panel left on MAN/OFF	Crimped ferrules, annual terminal torque check, AUTO key lock

HINGLISH

Impulse line = main pipe se pressure switch tak jaane wali patli nali. Single-point failure = ek chhoti kharabi jiski wajah se poora system fail ho jaye.

Chapter 2: Mechanical and Electrical Anatomy of a Pressure Switch

Inside the Pressure Switch Housing

Most industrial mechanical pressure switches used on Indian fire headers (Danfoss / Honeywell / Indfos styles) operate via two mechanical elements pushing against a snap-action electrical microswitch:

1. **Sensing Element (Bellows or Stainless Steel Diaphragm):** Moves upward cleanly as system water pressure rises.

2. **Range (Main) Spring & Adjusting Screw:** Sets the primary trigger threshold (Cut-Out or Cut-In depending on brand convention—**always read the datasheet engraved directly inside the lid**!).
3. **Differential Spring & Adjusting Screw:** Determines the **deadband width** between switching ON and switching OFF.

> **FORMULA**
> `For standard Upper-Cut-Out / Differential switches: Lower Switch Point (Cut-In) = Upper Switch Point (Cut-Out) – Differential` *(Note: Some brands specify Main Scale as Lower Cut-In and Differential sets Upper Cut-Out = Cut-In + Differential. Always confirm which convention your switch uses before turning any screw!)*

Reading NO, NC and COM Terminals Correctly

Inside the microswitch block sit three terminals:

- **COM (Common):** Live control phase (or 24V DC diesel trigger supply) enters here.
- **NC (Normally Closed — Closed when pressure is LOW / atmospheric):** Opens when pressure rises above the set threshold; **this is the terminal used for fire pump AUTO-START on pressure drop!**
- **NO (Normally Open — Open at atmospheric pressure):** Closes when pressure rises above threshold; sometimes used for high-pressure cutoff or indicator lights.

> **WARNING**
> Confirm whether your microswitch terminal labels refer to the shelf state (0 bar atmospheric pressure = NC closed) and double check with a continuity tester during calibration! Connecting the pump coil to the wrong terminal flips logic completely backward.

> **HINGLISH**
> Microswitch = pressure par tiktik karke bijli on/off karne wala chhota switch. Differential = on hone aur off hone ke pressure ke beech ka faasla (antar).

Chapter 3: Cascaded Pump Start-Stop Settings and Differential Design

Why Overlapping Thresholds Destroy Pumps

Fire pumps must wake up sequentially like staircase steps as water demand increases—never fighting each other at identical pressures.

1. **System Operating / Jockey Stop Pressure:** Highest static + friction design setpoint (e.g., 8.0 bar).
2. **Jockey Pump Cut-In:** ~0.8 to 1.0 bar below Jockey Cut-Out. Jockey starts first on tiny weeping drops and **auto-stops** when restored.
3. **Main Electric Pump Cut-In:** ~0.5 to 1.0 bar *below* Jockey Cut-In so an ordinary faucet drip never pulls an 80-amp electric motor online! **Manual stop only.**

4. **Standby / Diesel Engine Pump Cut-In:** ~0.8 to 1.0 bar *below* Main Electric Cut-In. Kicks in automatically if electric power is dead OR fire demand exceeds one pump. **Manual stop only.**

WORKED EXAMPLE

Cascaded Pressure Settings Schedule (Illustrative). System normal static + header duty pressure = **8.0 bar**. Let's construct a clean, non-overlapping pressure cascade table:

Pump Unit	Pressure Switch Action	Cut-In (Start) Pressure	Cut-Out (Stop) Pressure	Stopping Rule
Jockey Pump	Starts & Stops Automatically	**7.0 bar**	**8.0 bar**	Auto-Stop via Switch (Diff = 1.0 bar)
Main Electric	Starts on Fire/Breakage Drop	**6.0 bar**	Manual Push-Button	**NEVER Auto-Stop!**
Standby Diesel	Starts on Blackout or Heavy Flow	**5.0 bar**	Engine Panel Key/Button	**NEVER Auto-Stop!**

FIELD TIP

Always maintain at least **0.5 to 1.0 bar** deadband separation between steps so pressure gauge bounce and water-hammer ripples never accidentally start the Main Electric Pump during normal Jockey shut-off!

HINGLISH

Cascaded setting = ek ke baad ek seedhiyon ki tarah alag-alag pressure par pumps chalu hona. Deadband = do setting ke beech ka surakshit gap.

Chapter 4: Impulse Line Piping, Snubber, Pressure Tank and Drain Manifold

Building a Serviceable Sensing Tree

Never tap a pressure switch straight off a vibrating pump nozzle without an isolation, dampening, and test-drain arrangement.

