Centralized Lubrication Systems

The Complete Selection Guide

System architectures, selection framework, component sizing,
lubricant choice, installation essentials, and a printable field checklist.

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Centralized Lubrication Systems: The Complete Selection Guide

About This Guide

This guide is written for maintenance engineers, reliability engineers, and OEM designers who need to specify a centralized lubrication system for industrial machinery. It covers the five common system architectures, a structured selection framework, pump and distribution component sizing, lubricant choice, line sizing, monitoring, and a printable field checklist. Product ratings come from IsoHiTech published specifications; industry reference data is credited in the text and in the references section; worked calculations are marked as illustrative examples.

About IsoHiTech

IsoHiTech is the export brand of Nanjing Emitech Technology, a manufacturer of centralized lubrication equipment established in 1999. The product range covers grease and oil lubrication pumps (manual, pneumatic, and electric), progressive distributor blocks in the DJF1000, DJF2000, DJF2500, and DJF3000 series, PDI (positive displacement injector) metering units, dual-line metering valves in the ZVB and VSG series, and the associated fittings, tubing, and monitoring accessories. Systems built from these components serve construction machinery, machine tools, steel and cement plants, harbor equipment, and general industry.

1. What Is a Centralized Lubrication System?

A centralized lubrication system delivers metered amounts of grease or oil from a single reservoir to many lubrication points on a machine, on a timed or continuous cycle. Instead of a technician visiting each bearing with a grease gun, one pump pressurizes a distribution network that doses every point at the correct interval. The payoff is measurable: SKF attributes over 36% of premature bearing failures to poor lubrication (SKF Lubricants catalogue), and a centralized system directly attacks the two root causes behind that figure - missed intervals and inconsistent quantities.

Five architectures cover almost every industrial application. They differ in how the lubricant is metered and how the system behaves when one line is blocked.

1.1 Single-line resistance systems

The simplest architecture. A pump builds pressure on one main line, and each point receives lubricant through a resistance metering unit (a calibrated restrictor) while the line is pressurized. Output per point depends on line pressure and the restrictor bore, so doses are approximate. Best suited to oil systems on machine tools with modest point counts and short line runs.

1.2 Progressive (series) systems

The pump feeds a progressive divider block - a stack of piston sections that must complete their strokes in strict sequence. Each slice discharges a fixed volume to its outlets before the next slice can move. The defining characteristic is fail-safe behavior: if any single line blocks, the entire chain stalls, so one cycle indicator on the block confirms that every point was served. IsoHiTech DJF series blocks are progressive dividers of this type.

1.3 PDI injector systems (single-line parallel)

Each lubrication point has its own positive displacement injector. When the main line pressurizes, every injector fires its pre-set dose in parallel; when the line vents, the injectors reset for the next cycle. Each point can be adjusted individually, and points can be added or removed without re-balancing the network. Widely used on mobile equipment and mid-size industrial machines.

1.4 Dual-line systems

Two main lines alternate under pressure, switched by a reversing valve at the end of the line. Dual-line metering valves (such as the ZVB and VSG series) connect to both lines and discharge on each half-cycle. This architecture tolerates very long line runs, high back pressure, stiff greases, and low temperatures, and individual valves can be adjusted or isolated without stopping the rest of the system. It is the standard choice for steel mills, cement plants, and other large plants with hundreds of points over long distances.

1.5 Oil-air (oil-mist) systems

A stream of compressed air carries finely dosed oil to each point, providing both lubrication and cooling. Used mainly for high-speed spindles, rolling mill bearings, and other continuous-duty applications where heat removal

matters as much as film formation. Oil-air systems require a continuous air supply and mist venting provisions.

System type	Metering principle	Typical lubricant	Blocked-line behavior	Typical scale
Single-line resistance	Calibrated restrictor, pressure dependent	Oil	Other points unaffected; no inherent alarm	Small machine tools
Progressive (DJF blocks)	Fixed-volume pistons in series	Grease or oil	Chain stalls; one indicator supervises all points	Up to roughly 20 points per block stack
PDI injector	Adjustable positive displacement injector per point	Grease or oil	Other points unaffected; monitor line pressure	Tens of points, mobile and industrial
Dual-line (ZVB/VSG valves)	Two alternating mains, adjustable valve per outlet	Grease (incl. stiff grades) or oil	Other points unaffected; end-of-line pressure switch confirms cycle	Hundreds of points, long distances
Oil-air	Continuous oil dosing into air stream	Oil	Monitored via air and oil flow switches	High-speed or hot bearings

2. The Selection Framework

Most selection errors come from choosing a system type before quantifying the application. Work through five factors in order; together they point to one architecture and a short list of components.

Factor	Questions to answer	Points toward
Number of lubrication points	How many bearings, slides, chains, and pins need service? Will the count grow?	Up to about 20 points per stack: progressive. Tens of points: PDI. Hundreds of points: dual-line.
Distance and layout	How far is the furthest point from the pump? Are points clustered or spread over a plant?	Compact machines: progressive or PDI. Long runs and spread layouts: dual-line (rated to 40 MPa class valves).
Lubricant type	Oil or grease? Which NLGI grade at the coldest start-up temperature?	Oil only: resistance or oil-air. Grease NLGI #000-#2: progressive or PDI. Stiff grease, cold climate, or long lines: dual-line.
Environment	Temperature extremes, dust, wash-down, vibration, hazardous area?	Dusty plants need fill filtration (150 micron recommended on grease fills). No electrical supply allowed: pneumatic pump. Severe cold: dual-line with stiff-grease capability.
Monitoring needs	Must the machine PLC confirm every cycle? Is a local visual check enough?	Progressive: cycle pin or micro-switch per stack. PDI/dual-line: pressure switch plus controller. Full traceability: PLC-integrated pump.

Two rules of thumb fall out of the framework. First, point count and distance are hard constraints - a system that cannot reach or feed the furthest point fails regardless of its other merits. Second, the lubricant is a constraint, not an afterthought: a grease too stiff for the chosen architecture at winter start-up temperature will stall the system on the coldest morning of the year.

3. Pump Selection Basics

The pump sets the pressure class, the duty cycle, and the control interface for the whole system. Three drive types cover the field.

3.1 Electric pumps

Electric pumps are the default for fixed machinery and vehicles. Stationary machines typically use AC supply; mobile equipment uses DC. The IsoHiTech 20703 automatic grease pump family, for example, runs on AC 220/380 V or DC 12/24 V, develops up to 25 MPa, and drives one to three pump elements at about 5.5 ml/min each, with reservoirs from 2 to 12 L and NLGI #000 to #2 grease capability - a typical pairing for progressive blocks on machine tools and construction equipment. Heavier electric stations reach the 35 MPa class (IsoHiTech automatic pump range: up to 5,100 psi / 351 bar at 24 VDC) for dual-line and large progressive plants.

3.2 Pneumatic pumps

Air-operated pumps need no electrical connection, which makes them the choice for hazardous areas, wash-down zones, and sites where only compressed air is available. IsoHiTech pneumatic units operate on a 35-150 psi (2.5-10 bar) air supply, with output pressure set by the air ratio. Because output follows air pressure, always confirm the available plant air pressure at the pump location, not at the compressor nameplate.

3.3 Manual pumps

Hand and lever pumps suit low point counts, infrequent service intervals, standby equipment, and commissioning, and as backup fill and test pumps on larger installations. Manual pumps remove automation and monitoring, so they fit only where a missed interval has acceptable consequences.

Drive	Supply	Typical pressure class (IsoHiTech range)	Best fit
Electric AC	AC 220/380 V	Up to 25-35 MPa	Fixed industrial machines, progressive or dual-line
Electric DC	DC 12/24 V	Up to 25-35 MPa	Mobile equipment, off-grid installs
Pneumatic	35-150 psi air	Air-supply dependent	Hazardous areas, wash-down, no electrical supply
Manual	Hand / lever	Per model	Low point counts, backup, commissioning

Pressure class must exceed the sum of line losses, distributor cracking pressure, and bearing back pressure with margin. As a working check: progressive DJF1000 blocks are rated 16 MPa, DJF2000/2500/3000 blocks 25 MPa, and ZVB/VSG dual-line valves up to 40 MPa - the pump, hose, and fittings should be specified to at least the rating of the highest-rated component they feed, and the pump relief or vent setting below the rating of the weakest component.

4. Distribution Components: Progressive Blocks vs Injectors vs Dual-Line Valves

The distribution stage converts pump output into per-point doses. This is where most sizing decisions live.

4.1 Progressive blocks (DJF series)

A progressive stack consists of an inlet section, 3 to 10 working slices, and an end section. Each slice discharges a fixed volume per cycle through twin (T, both sides) or single (S, one side) outlets; unused outlets must never be plugged, because a blocked outlet stalls the whole chain and can overpressurize the stack. Cross-port kits combine outlets where a point needs a double dose. The four DJF families (IsoHiTech published specifications):

Series	Max pressure	Discharge per outlet	Body / seals	Slices / outlets	Inlet / outlet tube
DJF1000	16 MPa	0.08-0.48 ml/cycle	Aluminum	3-8 slices, up to about 18-20 points	Inlet 4/6/8 mm, outlet 4/6 mm
DJF2000	25 MPa	0.16-1.12 ml/cycle	Carbon steel	3-10 slices, 3-20 outlets	Inlet 8 mm, outlet 6 mm
DJF2500	25 MPa	0.08-1.28 ml/cycle	Zinc-plated steel, Viton seals	3-10 slices, 3-20 points	Inlet 8 mm, outlet 6 mm

Series	Max pressure	Discharge per outlet	Body / seals	Slices / outlets	Inlet / outlet tube
DJF3000	25 MPa	0.4-4.8 ml/cycle	Carbon steel, Viton seals	3-10 slices, 3-20 outlets	Inlet 10 mm, outlet 8 mm

All four families accept oil of ISO VG 68 and above or grease NLGI #000-#2 across -20°C to +60°C ambient, and all accept a mechanical cycle indicator pin or an electric micro-switch (type 8) for PLC supervision. Choose DJF1000 for compact machines and small doses, DJF2500 for fine twin doses from 0.08 ml/cycle at 25 MPa, DJF2000 as the general mid-range, and DJF3000 where large bearings need up to 4.8 ml/cycle per outlet.

4.2 PDI injectors

PDI injectors meter in parallel: each injector fires its set dose when the main line pressurizes and resets when the line vents. Per-point output is adjustable at the injector, and the network does not need re-balancing when points are added. The trade-off against progressive blocks is supervision: a blocked injector does not stall anything, so PDI systems rely on main-line pressure monitoring. PDI suits mobile equipment and machines where point counts change over time.

4.3 Dual-line valves (ZVB and VSG)

Dual-line metering valves connect to both main lines and discharge an adjustable volume on each half-cycle of the reversing valve. IsoHiTech published ratings:

Series	Pressure	Discharge	Outlets	Connections	Body
ZVB (SSPQ type)	Up to 40 MPa	0.5 / 1.5 / 3.0 cc models, adjustable by metering screw; indicator and switch options	1-8 per block; each valve serves two bearings, or one via cross-porting	Inlet 3/8 in, outlet 1/4 in	Zinc-plated carbon steel
VSG	35-400 bar operating range	Adjustable per outlet, up to 1.5 cm3/stroke standard (2.2 cm3 with special screw); 0.14 ml per turn increment	2, 4, 6, or 8 outlets	Inlet G3/8, outlet G1/4	Galvanized steel; stainless and FKM-seal variants

Choose dual-line when the plant is large (long main runs, high point counts), when the grease is stiff or the winters are cold, or when individual valves must be adjusted or isolated without disturbing the rest of the system. The VSG's G3/8 inlet gives higher flow capacity than smaller G1/4-inlet valves, which matters on long main lines.

4.4 Decision summary

- Compact machine, up to about 20 points, one indicator to prove every cycle: progressive DJF block.
- Mid-size machine, points added or adjusted over time, parallel firing preferred: PDI injectors.
- Large plant, long distances, stiff grease, per-valve isolation: dual-line ZVB/VSG.

5. Lubricant Selection

The distribution hardware and the lubricant are selected together. Two classification systems cover nearly every centralized system decision: NLGI consistency grades for grease and ISO VG grades for oil.

5.1 Grease: NLGI consistency

The NLGI grade classifies grease by worked penetration per ASTM D217 - how far a standard cone sinks into the worked grease at 25°C, in tenths of a millimetre. Higher penetration means softer grease. The grades relevant to centralized systems:

NLGI grade	Worked penetration (mm/10, 25°C)	Consistency	Centralized system use
000	445-475	Semi-fluid	Very cold climates, long lines, enclosed gear cases
00	400-430	Very soft	Cold-weather centralized systems
0	355-385	Soft	General centralized systems; good pumpability
1	310-340	Soft, smooth	Centralized systems, moderate temperatures
2	265-295	Firm, butter-like	General bearing grease; needs adequate pressure and short lines in centralized use

Penetration values per ASTM D217 / NLGI classification (source: FUCHS NLGI grade guide; KOYO bearing catalogue). The critical point is that NLGI grade is measured at 25°C but the system must pump the grease at the coldest start-up temperature, where consistency rises sharply: a grease that behaves like NLGI 2 in the workshop can behave like a much stiffer product at -20°C. Practical consequences:

- Progressive and PDI systems on IsoHiTech hardware are specified for NLGI #000-#2; stay inside that window at the actual operating temperature.
- For cold starts, drop one grade (for example from #1 to #0 or #00) rather than raising pump pressure beyond component ratings.
- Dual-line valves handle stiffer greases better thanks to 40 MPa class pressure; the VSG page rating extends to NLGI #3 class product.

5.2 Oil: ISO VG viscosity

ISO 3448 grades industrial oils by kinematic viscosity in centistokes at 40°C, with a tolerance of plus/minus 10% around the nominal midpoint. Common grades in centralized oil systems:

ISO VG grade	Viscosity range at 40°C (cSt)	Typical centralized use
VG 32	28.8-35.2	High-speed, lightly loaded bearings; cool indoor machines
VG 46	41.4-50.6	General circulating and hydraulic-duty systems
VG 68	61.2-74.8	Minimum grade for DJF progressive blocks on oil; general industrial bearings
VG 150	135-165	Heavier loads, slower speeds, warmer environments
VG 220	198-242	Heavily loaded slides, gear cases, hot conditions

Viscosity ranges per ISO 3448 (source: AIMS Industrial viscosity chart). Higher temperature thins oil and lower temperature thickens it, so select the grade for the operating temperature at the bearing, then confirm the cold-start viscosity is still pumpable through the longest line. IsoHiTech progressive blocks specify oil of ISO VG 68 and above at service temperature.

5.3 Compatibility checks

- Thickener compatibility: do not mix greases with incompatible thickener systems in one reservoir; when changing product, purge the system.
- Seal compatibility: standard blocks use NBR; Viton/FKM seal variants (DJF2500, DJF3000, VSG KRFKM option) suit higher temperatures and certain synthetic lubricants.
- Fill cleanliness: contamination enters most systems at the reservoir fill point. Use a fill filter - 150 micron is recommended on grease systems in dusty plants - and keep transfer equipment dedicated and capped.

6. Main Lines, Secondary Lines & Installation Essentials

Line sizing is a pressure-drop budget. The pump's available pressure is spent on three things: friction loss in the main line, the distributor's working requirement, and back pressure at the bearing. IsoHiTech practice by block family gives the tube sizes and run lengths that keep that budget in balance:

- DJF1000: inlet tube 4/6/8 mm, outlet tube 4/6 mm.
- DJF2000 / DJF2500: main line 8 mm (typical runs 1.5-4.5 m), branch lines 6 mm (typical 1.2-3.5 m).
- DJF3000: main line 10 mm (typical 1.8-5.5 m), branch lines 8 mm (typical 1.5-4.5 m).
- Dual-line: mains sized to plant length with G3/8 valve inlets (VSG) for high-flow runs.

Illustrative example: a press line needs 12 greased points within a 6 m radius, running NLGI #1 grease in a plant that sees -10°C winter mornings. A DJF2000 stack with 6 twin slices serves 12 outlets; an 8 mm main line of about 4 m and 6 mm branches of about 2 m stay inside the typical ranges above; a 25 MPa electric pump on AC 220 V covers the pressure class with margin; a type 8 micro-switch on the block reports each completed cycle to the press PLC. The winter constraint is handled by confirming the grease's pumpability at -10°C, or stepping to NLGI #0 for the cold season.

Installation essentials that decide whether the paper design survives contact with the plant:

- Never plug a progressive outlet; use cross-port kits to merge flow where a point needs more volume.
- Deburr and flush every tube before connection; assembly debris is the most common cause of new-system blockages.
- Secure lines against vibration with clips at regular intervals, and leave service loops at moving joints.
- Keep fill equipment clean and dedicated; fit the 150 micron fill filter on grease systems.
- Label each line at both ends; troubleshooting time drops sharply when every branch is identified.
- After commissioning, verify one full cycle at the indicator with the machine cold, not only warm.

7. Monitoring and Controls

Monitoring converts a lubrication system from a convenience into a reliability device. The minimum useful supervision confirms one thing per cycle: that lubricant actually moved.

7.1 Cycle indication on progressive systems

A mechanical indicator pin (type 7) or electromechanical micro-switch (type 8) mounted on a progressive block strokes once per complete stack cycle. One signal therefore proves every outlet on that stack fired - the core advantage of progressive logic. The IsoHiTech switch is rated 250 VAC 1 A or 125 VAC 3 A and wires directly to a PLC input. The host controller should alarm on a missing cycle signal within a set timeout, because a stalled chain means a blocked line downstream.

7.2 Pressure monitoring on PDI and dual-line systems

Parallel architectures supervise pressure rather than piston position. A pressure switch on the main line confirms that the line reached firing pressure (PDI) or that the far end of a dual-line system reached reversal pressure (end-of-line switch). IsoHiTech electric pump controllers support timer, pressure-switch, and PLC cycle termination with configurable vent pressure, so one pump platform covers both supervision styles.

7.3 Controller and PLC integration

Three control levels, in ascending order:

- Local timer on the pump: fixed interval, no feedback. Acceptable for non-critical points.
- Timer plus cycle or pressure feedback with alarm: the standard industrial minimum.
- Full PLC integration: interval tied to machine run hours, cycle confirmation per run, alarm and machine interlock on failure, event logging.

Whichever level is chosen, define the alarm response before commissioning: who is notified, within what time, and whether the machine interlocks. An alarm nobody acts on is worse than no alarm, because it documents a known failure.

8. Selection Checklist (Printable Worksheet)

Fill in the right-hand column on site, then compare against the guidance column. The completed sheet contains everything a supplier needs to quote a system.

Item	Your value	Guidance
Number of lubrication points (now / future)		About 20 per progressive stack; tens: PDI; hundreds: dual-line
Furthest point from pump (m)		Long runs favor dual-line; check tube size table in Section 6
Lubricant: oil ISO VG / grease NLGI grade		Oil at least VG 68 for DJF blocks; grease NLGI #000-#2 for progressive/PDI
Coldest start-up temperature (°C)		Confirm grease pumpability at this temperature, not at 25°C
Hottest ambient at components (°C)		DJF standard range -20 to +60°C; FKM seal variants for higher
Dust / wash-down / hazardous area?		Dusty: 150 micron fill filter; no electrics allowed: pneumatic pump
Power available at pump location		AC 220/380 V, DC 12/24 V, or 35-150 psi plant air
Required pressure class (MPa)		DJF1000: 16; DJF2000/2500/3000: 25; ZVB/VSG: up to 40
Dose per point per cycle (ml)		Match to size code: DJF1000 0.08-0.48; DJF2000 0.16-1.12; DJF3000 0.4-4.8
Cycle interval (min) and daily machine hours		Drives reservoir size and controller choice
Monitoring: visual pin / switch / pressure / PLC		Progressive: type 7 pin or type 8 switch; PDI/dual-line: pressure switch
Alarm response plan defined?		Owner, response time, and interlock decided before commissioning

9. Next Steps

A selection done on paper takes less than an hour with the checklist above, and it prevents the two expensive mistakes: an architecture that cannot reach or feed every point, and a lubricant the system cannot pump on the coldest morning. To automate the first pass, IsoHiTech publishes a free online selection tool based on the same framework: https://isohitech.com/lubrication-system-selector/. For a firm quotation with component-level sizing, send your completed checklist (or a machine sketch with point locations and distances) through the enquiry page: https://isohitech.com/contact-for-a-quote/. The more of the worksheet you can fill in, the faster the answer.

Sources and References

- IsoHiTech published product specifications (isohitech.com): DJF1000/2000/2500/3000 progressive block pages; ZVB and VSG dual-line valve pages; VSG-KR metering valve data; 20703 automatic grease pump page; automatic lubrication pumps (electric and pneumatic) data.
- NLGI consistency classification and worked penetration ranges, per ASTM D217 / NLGI (reference: FUCHS NLGI grade guide; KOYO bearing catalogue).
- ISO 3448 viscosity classification, kinematic viscosity ranges at 40°C (reference: AIMS Industrial ISO VG viscosity chart).
- Bearing failure statistics: SKF Lubricants catalogue - "Poor lubrication accounts for over 36% of premature bearing failures."