QUALITY INSPECTION TECHNICAL MANUAL
NON-SEALING PIPE THREAD (PARALLEL)

G Series (BSP Parallel) & NPS — Inspection & Acceptance

Document No.:	KFP-QIM-THD-004
Revision:	F
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Classification:	Internal Technical Document
Scope:	Parallel (non-sealing) pipe threads per ISO 228-1:2003 (G series) and ASME B1.20.1 (NPS). Mechanical connections only. Sizes 1/8″–6″. Does NOT cover tapered sealing threads (see THD-003).

IATF 16949 | ISO 9001 | ISO 14001 Certified Facility

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Revision History

Rev.	Date	Description & Triggering Standards	Author	Approved
A	2005-06	Initial release based on ISO 228-1:2000, ISO 228-2:1987. Established GO/NO-GO plug and ring gauge inspection for G-series threads.	Quality Eng.	Quality Dir.
B	2009-03	Added NPS (straight pipe thread) provisions from ASME B1.20.1. Clarified G/Rp interchangeability guidance. Added sealing gasket/O-ring interface inspection.	Quality Eng.	Quality Dir.
C	2013-09	Updated to ISO 228-1:2003 (current edition). Updated tolerance tables. Added CMM measurement protocol.	Quality Eng.	Quality Dir.
D	2016-11	Added optical sorting. Enhanced SPC for pitch diameter. Added coated thread guidance for G-series used in hydraulic fittings.	Quality Eng.	Quality Dir.
E	2019-08	Added assembly torque verification for mechanical pipe connections. Expanded gauge calibration to include long-series G threads.	Quality Eng.	Quality Dir.
F	2026-03	Comprehensive review. Verified ISO 228-1:2003 and ISO 228-2:1987 remain current. Added: post-coating verification, G/R mating compatibility matrix, short-batch protocol, packaging audit.	Quality Eng.	Quality Dir.

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1. Scope and Normative References

1.1 Scope

This manual covers parallel (straight) pipe threads used for non-pressure-tight mechanical connections where sealing is achieved by a gasket, O-ring, or bonded seal—not by the thread itself.

(a) ISO G series: external G (Whitworth form, 55°, parallel). Mates with Rp internal (parallel, sealing via washer) or G internal (mechanical only). Per ISO 228-1:2003.

(b) NPS (National Pipe Straight): ASME B1.20.1, 60° form, parallel. Mechanical joints only.

1.2 Normative References

Standard	Title / Scope
ISO 228-1:2003	Pipe threads where pressure-tight joints are NOT made on the threads — Part 1: Dimensions, tolerances, designation (G series)
ISO 228-2:1987	Pipe threads (non-sealing) — Part 2: Verification by means of limit gauges
ASME B1.20.1-1983 (R2001)	Pipe Threads, General Purpose (includes NPS straight thread specification)
ISO 16047:2005	Torque/clamp force testing

2. Thread Geometry

2.1 G-Series Profile (ISO 228-1)

The G-series thread is parallel (no taper), with 55° Whitworth form and rounded root/crest. Key parameters:

Parameter	G Series (ISO 228-1)	NPS (ASME B1.20.1)
Thread angle	55° (Whitworth)	60° (American National)
Taper	NONE (parallel)	NONE (parallel)
Root / crest	Rounded (R = 0.137P)	Flat root & crest
Tolerance system	Class A (tight) and Class B (standard)	Per ASME B1.20.1 tables
Sealing method	NOT by thread; requires gasket, O-ring, or bonded seal	NOT by thread; mechanical connection only

> **IMPORTANT:** G threads (55°) must NOT be mated with NPT threads (60° taper). G external CAN mate with Rp internal (parallel, ISO 7-1), but the seal is made by the gasket/washer, not the thread.

2.2 Compatibility Matrix

External	Internal	Compatible?	Seal Method
G (parallel, 55°)	G (parallel, 55°)	✓✓ Yes	Gasket / O-ring
G (parallel, 55°)	Rp (parallel, 55°)	✓✓ Yes	Bonded seal / washer
G (parallel, 55°)	Rc (taper, 55°)	⚠ Caution	Limited engagement; not recommended
G (parallel, 55°)	NPT (taper, 60°)	✗ No	Angle mismatch; will leak
NPS (parallel, 60°)	NPS (parallel, 60°)	✓✓ Yes	Mechanical; gasket if pressure
NPS (parallel, 60°)	NPT (taper, 60°)	⚠ Limited	Straight into taper; not pressure-rated

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3. Gauge System (per ISO 228-2)

ISO 228-2 specifies GO and NO-GO plug/ring gauges for G threads. The same GO/NO-GO acceptance logic applies as for ISO metric threads (see THD-001 Section 4). Key difference: G-thread gauges verify parallel thread fit, not taper engagement.

Test	PASS	FAIL	Action	Tag
GO (ext.)	Ring screws on fully	Ring does NOT fully pass	Segregate; check tooling	✓✓ **GREEN**
NO-GO (ext.)	Ring ≤2 turns	Ring >2 turns	Segregate; d_2 undersize	✗ **RED**
GO (int.)	Plug screws in fully	Plug does NOT fully pass	Segregate; check tap	✓✓ **GREEN**
NO-GO (int.)	Plug ≤2 turns	Plug >2 turns	Segregate; D_2 oversize	✗ **RED**

> **Note:** *G-thread gauges are NOT interchangeable with R/Rc gauges (which are tapered). Ensure correct gauge selection.*

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4. Inspection Equipment

Equipment	Specification	Parameters Measured	Application
GO/NO-GO gauges	Per ISO 228-2; Class A and Class B sets	Functional parallel thread fit	100% in-process + final
CMM	Acc. ±0.001 mm	Pitch dia., major/minor dia., pitch, parallelism	FAI, PPAP, audit
Profile projector	10×–50×; 55° overlay for G, 60° for NPS	Thread angle, root form	Form verification
Optical sorter	0.01 mm/pixel	Thread presence, major dia., damage	100% final sort
Micrometer	0.001 mm	Major diameter	SPC checks
AMETEK OES	Multi-element	Material verification	Incoming

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5. Inspection Procedures

Inspection procedures follow the same structure as THD-001 (incoming → FAI → SPC → final → packaging audit). G-series specific points:

(a) Class A vs. Class B: verify drawing callout. Class A is tighter tolerance for precision hydraulic fittings; Class B is standard.

(b) O-ring groove inspection: when G-thread fitting has an O-ring seal face, inspect groove dimensions (diameter, width, depth, surface finish Ra ≤1.6 μm) as part of thread assembly verification.

(c) Coated threads: same post-coating gauge verification as THD-001 Section 3.3.

(d) Assembly function test: verify smooth hand engagement with calibrated mating part; check face seal compression with O-ring installed.

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Non-Conformance Handling and Disposition

Standard NC Procedure

Step	Action
1. Containment	STOP production. Segregate with RED tag. Quarantine. NCR Form KFP-NCR-001.
2. Scope	Trace to last good inspection. Re-inspect 100% of suspect window.
3. Root cause	8D/5-Why analysis. Common: tool wear, wrong setup, gauge error, material variation.
4. Disposition (MRB)	REWORK / USE-AS-IS (customer concession) / SCRAP.
5. Corrective action	Permanent fix; verify effectiveness over ≥3 production lots.
6. Customer notification	If NC product shipped: 24-hr notice + 8D per IATF 16949 §8.7.1.6.

Records, Traceability & Documentation

Record	Doc ID	Retention	Storage
Material cert (EN 10204 3.1)	Per lot	15 yr (auto) / 10 yr	QMS + archive
OES report	KFP-MAT-OES-[lot]	= material cert	QMS
FAI report	KFP-FAI-[part]-[date]	Part life + 1 yr	QMS
SPC charts	Auto-generated	Current + 2 yr	SPC database
Gauge log	KFP-GAG-LOG-[line]	Current + 1 yr	QMS
CMM thread report	KFP-CMM-THD-[part]	Part life + 1 yr	QMS + PDF
Final inspection	KFP-FIN-[lot]-[date]	15 yr (auto)	QMS
NCR / 8D	KFP-NCR-[seq]	Part life + 3 yr	QMS
Gauge cal cert	KFP-CAL-[gauge ID]	+ 2 cal cycles	QMS
PPAP package	Per customer	Part life + 1 yr EOL	QMS + portal

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Document Approval

Reviewed and approved by:

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Prepared by:	Quality Engineer		
Reviewed by:	Production Manager		
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END OF DOCUMENT

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