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APPROVAL & DISTRIBUTION

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	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM		Doc. No	GIT-EA-URS-0015
			Revision	01
			Page	2 of 12

TABLE OF CONTENTS

APPROVAL & DISTRIBUTION	1
REVISIONS	3
1 PURPOSE	4
2 BUSINESS OBJECTIVES.....	4
3 REFERENCES, ABBREVIATIONS AND DEFINITIONS	4
4 REQUIREMENTS	5
4.1 General System Requirements	5
4.2 Weld Tracking and Traceability	6
4.3 Materials Traceability	7
4.4 Welding Procedure Specification (WPS)	7
4.5 Procedure Qualification Record (PQR) Management.....	8
4.6 Welder and Welding Operator Qualification Management.....	8
4.7 Inspection and Non-Destructive Testing (NDT) Integration	9
4.8 Repair and Non-Conformance Management.....	9
4.9 Documentation and document control.....	10
4.10 Reporting and Analytics	10
4.11 Data Migration and Legacy Integration.....	11
4.12 END-OF-LIFE AND DATA EXTRACTION.....	11
4.13 Testing requirements	11
5 SUPPORT	12

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	3 of 12

REVISIONS

This document has been revised in accordance with the following schedule:

Rev. No.	Date approved	Nature of Revision	Revision Date	Prepared
01	Refer to cover page	First issue		

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	4 of 12

1 PURPOSE

The purpose of this document is to define the user and business requirements for a Welding Management System (WMS). The system shall provide comprehensive lifecycle management of welding operations including, but not limited to: welder qualification lifecycle management, Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) control, weld traceability and mapping, inspection and Non-Destructive Testing (NDT) integration, quality control, compliance monitoring, and reporting and analytics.

2 BUSINESS OBJECTIVES

The system shall:

- Improve weld traceability and visibility.
- Eliminate manual spreadsheets and paper-based records.
- Improve compliance with welding standards and customer requirements.
- Reduce welding defects and rework.
- Improve audit readiness.
- Provide real-time project status reporting.
- Centralize welding documentation.
- Improve productivity and quality control.

3 REFERENCES, ABBREVIATIONS AND DEFINITIONS

Term	Definition
WPS	Welding Procedure Specification
PQR	Procedure Qualification Record
WPQR	Welder/Welding Operator Performance Qualification Record (EN/ISO terminology)
WPQ	Welder Performance Qualification (ASME/AWS terminology)
NDT	Non-Destructive Testing
NDE	Non-Destructive Examination

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	5 of 12

4 REQUIREMENTS

4.1 GENERAL SYSTEM REQUIREMENTS

Req. ID	Requirement Statement
GEN-001	The system shall be deployable as a cloud-hosted (SaaS), on-premises, or hybrid solution, configurable per organizational security policy. Where a cloud-based deployment model is proposed, the system shall be hosted exclusively within the borders of South Africa.
GEN-002	The system shall be a multi-user, role-based web application accessible via standard modern web browsers (Chrome, Edge, Firefox — latest two major versions)
GEN-003	The system shall support concurrent users without performance degradation, with defined SLAs for response time (≤ 2 seconds for standard transactions under normal load).
GEN-004	The system shall provide a configurable, role-based access control (RBAC) framework
GEN-005	The system shall support single sign-on (SSO) via SAML 2.0, OAuth 2.0, or OpenID Connect, and integrate with enterprise directories (Active Directory, LDAP).
GEN-006	The system shall provide a documented RESTful API and/or OData interface for integration with enterprise systems including ERP, PLM, MES, CMMS, and document management systems.
GEN-007	The system shall comply with 21 CFR Part 11 and EU Annex 11 requirements for electronic records and electronic signatures where applicable.
GEN-008	The system shall enforce electronic signatures that are unique to the individual, include date/time stamp
GEN-009	Electronic signatures shall be linked to their respective electronic records such that signatures cannot be excised, copied, or otherwise transferred to falsify records.
GEN-010	The system shall provide administrative interfaces for configuration of: organizational structure, projects, user roles, workflows, code libraries, material libraries, and system parameters.
GEN-011	The system shall maintain a complete, immutable, computer-generated audit trail that independently records the date, time, user identity, and nature of all record creation, modification, and deletion actions.
GEN-012	Audit trail entries shall not be modifiable or deletable by any user, including system administrators.
GEN-013	The system shall support configurable data retention periods aligned with code requirements.
GEN-014	The system shall provide archival functionality that preserves records in unalterable, retrievable format.
GEN-015	The system shall maintain record accessibility and readability throughout the defined retention period, including after system upgrades or migrations.
GEN-016	The system should provide a responsive mobile access web interface optimized for tablets and a dedicated mobile app (iOS/Android) for offline data capture of inspections, weld logs, and NDT results.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	6 of 12

Req. ID	Requirement Statement
GEN-017	Offline Capability – When disconnected, the mobile app shall store data locally (encrypted) and synchronize automatically when connectivity is restored, with conflict resolution rules defined.

4.2 WELD TRACKING AND TRACEABILITY

Req. ID	Requirement Statement
WTR-001	The system shall assign and manage unique weld identification numbers to each weld record upon creation. The numbers must be configurable to organisational conventions, and shall not be reused or modified after creation.
WTR-002	The system shall capture and store weld joint attributes including: joint number, weld type (butt, fillet, socket, etc.), joint configuration, base material specification, thickness, diameter, batch/heat number and certificate reference.
WTR-003	The system shall record the governing code(s) and acceptance criteria applicable to each weld joint.
WTR-004	The system shall provide full forward and backward traceability for each weld, linking: the source raw material heat/lot (via material heat number), the filler material certificate, the approved WPS/PQR, the qualified welder record, the NDT/inspection results, and any non-conformance or repair records.
WTR-005	The system shall support the recording of weld repairs, re-welds, and cut-outs, maintaining a complete and immutable history of all work performed on a given joint. Original weld records shall not be deleted; repair cycles shall be appended as child records.
WTR-006	The system shall track real-time weld status through configurable workflow states (e.g., Pending, In Progress, Fit-Up Complete, etc.).
WTR-007	The system shall enforce workflow rules preventing progression to subsequent states without completion of prerequisite activities (e.g., no NDT release without completed VT).
WTR-008	The system shall flag and report non-conforming welds
WTR-009	The system should allow bulk weld record import via a validated, versioned CSV or Excel template with field-level validation and error reporting prior to commit.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	7 of 12

4.3 MATERIALS TRACEABILITY

Req. ID	Requirement Statement
MAT-001	The system shall maintain a materials register linking all base materials to their CMTRs, heat numbers, material specifications (ASTM, EN, etc.), and mill source.
MAT-002	The system shall capture all essential, supplementary essential, and non-essential variables as defined by the applicable code.
MAT-003	The system shall enforce material specification compatibility checks between base material and selected WPS.
MAT-004	The system shall support Positive Material Identification (PMI) result capture and linkage to material records.
MAT-005	The system shall maintain filler material inventory with tracking by AWS/EN classification, brand, heat/lot number, and expiration date (where applicable).
MAT-006	The system shall track filler material receipt, storage conditions (rod oven temperatures, exposure time limits), issue, return, and consumption.
MAT-007	The system shall enforce low-hydrogen electrode exposure time limits per code requirements and alert users when limits are approached or exceeded.
MAT-008	The system shall track shielding and backing gas batch/lot numbers and link consumption to specific weld joints.
MAT-009	The system shall prevent issuance of expired or non-conforming consumables and provide alerts for approaching expiration.

4.4 WELDING PROCEDURE SPECIFICATION (WPS)

Req. ID	Requirement Statement
WPS-001	The system shall provide structured templates for Welding Procedure Specifications compliant with ASME Section IX (QW-482), EN ISO 15609, and AWS requirements.
WPS-002	The system shall validate that WPS parameters fall within the qualified ranges established by supporting PQR(s).
WPS-003	The system shall support multiple PQRs supporting a single WPS and multiple WPSs derived from a single PQR, with managed linkages.
WPS-004	The system shall enforce version control with full revision history, preventing unauthorized modification of approved WPSs.
WPS-005	The system shall provide WPS approval workflow with configurable review/approval stages and electronic signatures.
WPS-006	The system shall alert users when a WPS is used outside its qualified scope (material, thickness, diameter, position, process).
WPS-007	The system shall support WPS status management (Draft, Under Review, Approved, Superseded, Withdrawn) with status-based access controls.
WPS-008	The system shall generate formatted, print-ready WPS documents conforming to code-required formats.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	8 of 12

4.5 PROCEDURE QUALIFICATION RECORD (PQR) MANAGEMENT

Req. ID	Requirement Statement
PQR-001	The system shall provide a structured PQR data entry module capturing all test weld parameters, mechanical test results (tensile, bend, impact, hardness, macro-examination), and NDT results as required by the applicable qualification standard.
PQR-002	The system shall capture all essential, supplementary essential, and non-essential variables as defined by the applicable code.
PQR-003	The system shall record all mechanical test results (tensile, bend, impact, macro, hardness, etc.) with linkage to applicable test reports and certificates.
PQR-004	The system shall support attachment and linkage of NDT reports, photographs, and supporting documentation to PQR records.
PQR-005	The system shall calculate and validate whether recorded mechanical test results meet the minimum acceptance criteria defined by the applicable code. Failing results shall be highlighted and shall prevent PQR approval.
PQR-006	The system shall enforce electronic signature workflow for PQR review and approval.
PQR-007	The system shall generate a formatted, print-ready PQR report matching the layout requirements of QW-483 (ASME IX) and the equivalent EN ISO 15614 forms, including all test data, witness signatures (electronic), and supporting document references.

4.6 WELDER AND WELDING OPERATOR QUALIFICATION MANAGEMENT

Req. ID	Requirement Statement
WQM-001	The system shall maintain a centralised Welder Qualification Register recording the full qualification history of every registered welder, including apprentice and contractor personnel.
WQM-002	The system shall support simultaneous qualification tracking under multiple codes and standards for a single welder (e.g., ASME IX, EN ISO 9606-1, AWS D1.1). Qualifications under each standard shall be maintained as discrete records with independent validity periods.
WQM-003	The system shall support multi-code qualification tracking, allowing a single test to qualify a welder under multiple codes (ASME, EN ISO, AWS) with code-specific scope calculations.
WQM-004	The system shall automatically calculate and display the full range of approval (qualified range) for each welder qualification based on the essential variables defined in the applicable code.
WQM-005	The system shall automatically calculate qualification expiry dates in accordance with the relevant code.
WQM-006	The system shall issue automated, configurable alerts prior to qualification expiry
WQM-007	The system shall automatically prevent a welder whose qualification has expired or is not applicable to the assigned WPS from being assigned to a weld record. This shall be a hard system control, not a warning.
WQM-008	The system shall maintain complete qualification history including all renewals, extensions, lapses, and revocations.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	9 of 12

4.7 INSPECTION AND NON-DESTRUCTIVE TESTING (NDT) INTEGRATION

Req. ID	Requirement Statement
NDT-001	The system shall provide structured inspection checklists for fit-up, in-process, and final visual examination per code requirements.
NDT-002	The system shall support the generation and management of Inspection Requests (IR) and Inspection Release Notes (IRN) with assigned inspector, required date, and linked weld records.
NDT-003	Weld inspection logs shall capture: inspection date and time, inspector identity and certification level (e.g., CSWIP 3.1, AWS CWI, EN ISO 9712 Level 2), inspection method, acceptance criteria applied (code and clause reference), findings/defect observations (using standard defect notation), and accept/reject disposition with justification.
NDT-004	The system shall support the recording and tracking of non-conformances (NCRs) raised during inspection, linking each NCR to the affected weld record(s), the root cause analysis, corrective action, and close-out evidence.
NDT-005	The system shall manage NDT requirements by weld joint, automatically applying sampling plans and extent of examination per code, client, or project specification.
NDT-006	The system shall generate and manage NDT work packages with weld lists, required methods, and scheduled dates.
NDT-007	The system shall track NDT status by weld joint through workflow states (Scheduled, In Progress, Evaluated, Accepted, Rejected, Pending Repair).
NDT-008	The system shall capture and store defect indications with location (linear/circumferential position), size, characterization, and disposition.
NDT-009	The system shall apply acceptance criteria from governing code and automatically determine accept/reject status where criteria are deterministic.
NDT-010	The system shall require NDT operator/evaluator and reviewer electronic signatures on NDT reports.
NDT-011	The system shall link NDT reports to weld joints, enabling consolidated view of all examinations performed on a given weld.
NDT-012	The system shall maintain NDT personnel certification records
NDT-013	The system shall enforce restrictions preventing NDT personnel from evaluating or approving examinations outside their certified scope.
NDT-014	The system shall provide advance notification alerts for approaching NDT certification expiration.

4.8 REPAIR AND NON-CONFORMANCE MANAGEMENT

Req. ID	Requirement Statement
REP-001	The system shall enforce structured repair workflow including: defect identification, repair procedure assignment, repair execution, and re-examination.
REP-002	The system shall track repair iterations per weld joint, enforcing maximum repair attempt limits per code or project specification.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	10 of 12

Req. ID	Requirement Statement
REP-003	The system shall link all repair activities to the original weld joint while maintaining distinct traceability for each repair cycle.
REP-004	The system shall require use of approved repair WPS for all repair welding and validate welder qualification for repair scope.
REP-005	The system shall generate or integrate with non-conformance reports for rejected welds, with structured fields for defect description, root cause, disposition, and corrective action.
REP-006	The system shall support NCR workflow including initiation, review, disposition approval, corrective action tracking, and closure with appropriate signature requirements.
REP-007	The system shall support configurable NCR categorization and severity classification.

4.9 DOCUMENTATION AND DOCUMENT CONTROL

Req. ID	Requirement Statement
DOC-001	The system shall provide integrated document management for all welding-related documents including WPSs, PQRs, WPQRs, NDT procedures, ITPs, specifications, and drawings.
DOC-002	The system shall enforce document version control with check-in/check-out, revision history, and supersession management.
DOC-003	The system shall support document approval workflows with configurable review/approval stages and electronic signatures.
DOC-004	The system shall maintain document distribution control with acknowledgment tracking.
DOC-005	The system shall support document categorization, tagging, and full-text search.
DOC-006	The system shall prevent access to superseded or withdrawn documents in normal workflows while maintaining archival access for audit purposes.

4.10 REPORTING AND ANALYTICS

Req. ID	Requirement Statement
RPT-001	The system shall provide standard report templates including: weld log, welder qualification matrix, WPS index, NDT summary, NCR register, and weld completion status.
RPT-002	All standard reports shall be exportable in PDF (with embedded audit metadata), Excel (XLSX), and CSV formats. PDF exports shall be non-editable and shall include the system-generated electronic signature display block where applicable.
RPT-003	The system shall provide ad-hoc query and report builder functionality allowing users to create custom reports without vendor intervention.
RPT-004	The system shall provide customizable report templates (Work pack management, production report, project data books, Management of repairs (linking repair slip to

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	11 of 12

Req. ID	Requirement Statement
	rejected welds), welder performance report & repair rate, Project Reports (project analysis, final manufacturing report, weld progress report (i.e. total vs completed, % exportable in Pdf/excel) and KPIs & report follow-up.
RPT-005	The system shall support scheduled report generation and automated distribution via email to configurable recipient lists at defined intervals (daily, weekly, monthly, or triggered by threshold breach).
RPT-006	Real Time Dashboards and Trend Analysis – The system shall provide configurable, live dashboards with graphical KPIs: first pass yield, welder defect rate, NDT backlog, repair rate by WPS, project progress, defect rate over time, and welder performance trending. Dashboards shall be exportable as PDF/PNG.

4.11 DATA MIGRATION AND LEGACY INTEGRATION

Req. ID	Requirement Statement
DML-001	The vendor shall provide a documented data migration plan covering extraction, cleansing, transformation, load, validation, and rollback.
DML-002	The system shall support batch import of legacy weld data (CSV, Excel, or XML) with field level validation and error reporting before commit.
DML-003	Post migration, the system shall generate a reconciliation report showing record counts and exceptions.

4.12 END-OF-LIFE AND DATA EXTRACTION

Req. ID	Requirement Statement
EOL-001	The vendor shall provide a minimum 24 months' written notice before discontinuing any version or the entire product.
EOL-002	Upon termination, the vendor shall provide a documented data export utility that extracts all weld records, documents, audit trails, and images in open, machine readable formats (JSON, XML, PDF/A, CSV).
EOL-003	The export utility shall be validated and made available at no additional cost during the notice period.

4.13 TESTING REQUIREMENTS

Req. ID	Requirement Statement
TES-001	For every new version (major, minor, patch), the supplier shall provide an upgrade test plan that includes: backup/restore validation, forward compatibility of existing data, and rollback procedure validation.

	USER REQUIREMENTS FOR A WELDING MANAGEMENT SYSTEM	Doc. No	GIT-EA-URS-0015
		Revision	01
		Page	12 of 12

Req. ID	Requirement Statement
TES-002	An upgrade test report shall be signed off by both supplier and NECSA before the upgrade is applied to production.
TES-003	The supplier shall assist NECSA with UAT, Integration test, performance test etc. of the upgrades and new installation of the application.

5 SUPPORT

The bidder/service provider is required to provide comprehensive information addressing the following areas:

- An overview of the customer support and maintenance services offered.
- The cost of the annual maintenance plan.
- Provision of 3 years of post-implementation support to assist with system stabilization.
- A commitment to regularly train service and support staff, as necessary, to ensure up-to-date knowledge and skills.
- Delivery of service and support in accordance with the agreed Service Level Agreement (SLA).
- After-hours emergency contact details, including applicable service rates for support provided outside regular business hours.
- Detailed information on the frequency of new software version releases.
- A proposed plan for implementing new releases and upgrades (e.g., scheduling during weekends or non-business hours).
- The process followed for testing new versions, upgrades, and patches prior to deployment.
- A detailed migration process to be followed when upgrading to new software versions.