

Table 2 — Customer Data Requirements for SSR - TDE-AOD™

What information is required from the customer?

The implementation level depends on the quality, depth and availability of plant data. The matrix below shows what is typically needed for each TDE-AOD™ deployment level.

Legend:

● Required ◐ Recommended ○ Optional — Not required

| Required input from customer | Offline Simulator | DSS / Advisory Mode | Online Digital Twin |
|---|-------------------|---------------------|---------------------|
| Basic AOD plant data (converter size, nominal heat size, vessel type, tuyere arrangement, main equipment) | ● | ● | ● |
| General AOD process description (refining philosophy, oxygen blowing logic, inert gas practice, reduction stage, desulfurization stage) | ● | ● | ● |
| Typical operating values (hot metal or EAF melt arrival conditions, initial chemistry, target chemistry, target temperature, treatment duration) | ● | ● | ● |
| Standard recipes / operating practice | ● | ● | ● |
| Historical treatment results (final temperature, final chemistry, chromium yield, oxygen used, inert gas consumption, alloy additions, slag practice) | ◐ | ● | ● |
| Heat-by-heat / treatment-by-treatment production data | ○ | ● | ● |
| Time-stamped process sequence (oxygen blowing phases, inert gas phases, alloy additions, slag additions, sampling events, temperature measurements) | ○ | ◐ | ● |
| Actual process measurements during operation | ○ | ● | ● |
| Oxygen flow data | ○ | ● | ● |
| Inert gas flow data (argon, nitrogen, or other gases, if applicable) | ○ | ● | ● |
| Temperature measurement data | ◐ | ● | ● |
| Chemistry and sampling data | ◐ | ● | ● |
| Alloy addition data | ○ | ● | ● |

| Required input from customer | Offline Simulator | DSS / Advisory Mode | Online Digital Twin |
|---|----------------------------------|----------------------------------|----------------------------------|
| Slag practice data (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Off-gas data (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Reduction and trimming stage data | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| AOD refractory design data (converter zoning, tuyere area design, material grades, nominal thickness) | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Refractory campaign history and converter repair records | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Refractory consumption and campaign life records (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Shell temperature / hot spot history (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Detailed chromium balance and recovery records by treatment stage (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Slag chemistry history relevant to chromium recovery and refractory attack (if available) | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| List of available data sources (Excel, CSV, historian, database, Level 2, etc.) | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Live signal availability | — | <input type="radio"/> | <input checked="" type="radio"/> |
| PLC / Level 1 / Level 2 tag list | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Tag description and engineering units | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Data communication architecture (OPC-UA, database, API, historian, network constraints) | — | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Automation sequence and phase logic | — | <input type="radio"/> | <input checked="" type="radio"/> |
| IT / OT environment and deployment constraints | — | <input type="radio"/> | <input checked="" type="radio"/> |
| Customer expectations and project objectives | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |

TDE-AOD™ can start as an Offline Simulator and progressively evolve into DSS / Advisory Mode and a fully integrated Online Digital Twin as plant data availability increases.

Note on data quality and consistency

The quality of TDE™ outputs depends on the accuracy, completeness, time alignment and engineering consistency of the data provided by the customer. Whenever available, data should be supplied with clear units, time stamps, signal descriptions, process phase references and indication of measurement source. Inaccurate, incomplete or non-



synchronized data may still allow a preliminary implementation, but with reduced predictive strength and advisory precision.

Note on chromium-related analyses

Chromium yield assessment, chromium recovery control and decarburization-versus-chromium-loss optimization are significantly improved when chemistry, sampling, alloying, slag and stage-by-stage treatment data are available in a consistent and time-aligned format.

Note on refractory-related analyses

Refractory optimization, lining wear interpretation, campaign life support and slag/refractory interaction assessment can be significantly improved when the customer provides refractory design data, lining zoning, material grades, campaign history, repair records, shell temperature information, hot spot history and refractory consumption records.