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| Installation Readiness Review for the Target Moderator Cryoplant (TMCP)Year – Month - Day |
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| **Charge for the IRR**  |
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Purpose of this IRR

The IRR is meant to be the technical review of the system prior to the start of installation. As such, it examines the final technical design of the integrated system with an emphasis on interfaces between components and subsystems and a detailed look at the plans, staff and tooling required for the installation work itself.

There shall be another design review of the interconnecting piping between the Linde supplied components and between the components and the ESS interfaces.

There shall furthermore be a ready-for-start-up review before machinery is switched on and the system is pressurised, focussing on control system readiness, start-up preparations and commissioning activities.

**Charge to the Committee**

The Review Committee is composed of the Chairman and members as identified in Appendix 2. This list also shows reviewers, who provide comments and review but are not on the formal committee and presenters.

 The Review Committee is asked to:

1. REVIEW: Scrutinize and assess the deliverables listed in Appendix 1, presented through the material presented and discussions, at the IRR. Note that the presentations themselves are means of communication only, and it is the documentation that must be reviewed.

2. ANSWER: Answer each question listed in Appendix 3.

3. DECIDE: The Review Committee is to elaborate and deliver at the conclusion of this IRR, a clear recommendation to ESS about the readiness of the Target Moderator Cryoplant and its associated systems to be installed at the ESS site and the readiness of the ESS site to receive such an installation.

Suggested forms for the decision are:

* Approved, without qualifying comments or further actions.
* Approved, but with recommended actions and or clarifications.
* Not approved, but with recommended actions, for further inputs and activities, and a proposal for a follow-on review.

(If the committee rules for “Approved with recommended actions” or “Not approved” of the IRR, it is of essence that the actions/comments requested are very precise in their formulation and that the fulfilment decision is transferred to LInde and ESS, all this due to time constraints in the installation schedule and sequence).

4. REPORT: The Review Committee is to document in a short report to be delivered as soon as possible after the IRR, its recommendation and any specific actions and other guidance for assisting planning and future success of the Work Unit in for its scope and deliverables.

If the IRR is “Approved but with recommended actions”, there shall be a summary list of requested actions defined.

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| Appendix 1**Scope and Deliverables for Review** |
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Scope

The scope for the review includes:

* All the components of the TMCP that will be installed at the ESS site in Lund
* Installation plans including WSCP with annexes, required permits, tooling, cranes, personnel requirements, alignment issues, material transport, laydown area requirements
* Installation and commissioning schedule
* Readiness of supporting utilities (water, electrical power, instrument air). This will be provided by ESS staff.
* Quality Assurance and Quality Control Organisation of the delivered equipment as well as of the installed pipe work, supports, cabling etc.
* Safety aspects
* Reliability

Deliverables for IRR - Information to be reviewed

The information identified below is to be described and communicated through presentation at the IRR, and the source information is to be available to reviewers for reference during the IRR.

Linde is requested to deliver to the IRR Chairman for distribution to the Review Committee and other reviewers, an agreed subset of the following information for pre-review and comments no later than Ten (10) working days prior to the CDR.

1. Mechanical design at a sufficient detail to answer interface, performance, alignment and installation questions below.
2. Electrical design including: single line drawings, instrumentation lists, cable designs and connector pin outs, calibrations etc.
3. Integrated controls system design and documentation sufficient to answer charge questions.
4. System Verification plan
5. Detailed Installation plan including, if needed, alignment strategy.
6. Hazard analysis
7. Work Safety Coordination Plan including all its Annexes (Job Hazard Analysis, System Deliverables, Equipment List etc.)
8. Results of relevant component and subsystem testing
9. RAMI report and list of needed spares for start of operation
10. Installation schedule
11. Operation manuals of all delivered equipment in English
12. Maintenance manuals of all delivered equipment in English
13. Transport and delivery plan including package sizes, weights, identification and handling instructions

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| Appendix 2**Review Committee and other Reviewers, Presenters and Observers** |

The IRR Committee conducts this review of design with the authority of TS Project Leader, Mark Anthony, and ESS Chief Executive Officer, John Womersley.

The Committee serves in an advisory capacity to:

* the ACCSYS WP 11 Leader,
* the TS WP3 leader and
* the TS management team

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| Name | Organisation | Appointment for IRR |
| John Weisend II | ESS, ACCSYS Deputy Project Leader | Chairman of the Review Committee  |
| Duy Phan | ESS, ACCSYS Safety Group  | Review Committee member |
| Daniel Lyngh | ESS, TS WP3 Manager | Review Committee member |
| Ila Sjoholm | ESS, Area Manager, Cryogenics Section | Review Committee member |
| John Jurns | ESS, TMCP Project Engineer | Review Committee member |
| Philipp Arnold | ESS, Cryogenics Section Leader | Review Committee member |
| Kent Wigren | ESS, ACCSYS QA Engineer | Review Committee member  |
| xxx (if available) | ESS, CMS Project Engineer | Review Committee member |
| Evangelia Vaena | ESS, Electrical Engineer | Reviewer |
| Fabien Rey | ESS, Alignment Group Leader | Reviewer |
| Benedetto Gallese | ESS, ICS coordinator | Reviewer |
| Xiaotao Su | ESS, Cryogenic Engineer | Reviewer |
| Piotr Tereszkowski | ESS, Designer | Reviewer |

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| Appendix 3**IRR Charge Questions** |

1. Will the system meet its technical specifications? Do we know how to verify this?
2. Are the interfaces between the various components and subsystems that compose this system completed defined in terms of: a) physical connection – location and type of mating flanges, location and type of power and cable connections, support stands etc. and b) physical parameters (flows, pressure, temperatures, current, voltage, data acquisition formats and rates etc.)
3. Have all interfaces between this system and other systems been completely defined and agreed. Are all the connections on the ESS site in place? This applies to physical connections, physical parameters (flows, pressure, temperatures, current, voltage, UPS requirements) and data exchange.
4. Have all safety issues been defined and dealt with? Are additional separate safety reviews or inspections required?
5. Have all QA/QC plans been defined and implemented?
6. Will the system fit within its allocated space and can be transported there within the given transport path (height of doors, pass by other equipment) with the available transport means? This applies for G.02, G.04 and the hydrogen room in the target building as well.
7. Are the alignment requirements agreed upon and can the system components be aligned within these requirements?
8. Is the installation plan for the system adequate? Have all tools, including cranes, movement devices, stands, alignment fixtures etc. been defined. Has the staff for this work been identified? Is the installation sequence consistent with the overall installation plan?
9. Has the reliability and maintainability of the system been reviewed? Have all the spare parts required from the first day of operation been identified and procured?
10. Have all inspections and permits required prior to installation been carried out?
11. Have all recommendations from component design reviews been addressed?