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Technical Specifications (In-Cash Procurement)

Technical Specification : Procurement and installation of a heavy duty (HD) robot as part of the development of a robot test cell

This document details the technical specifications necessary for the purchase of a heavy duty (HD) robot for the development of a robot test cell. The ITER Organization (IO) Remote Handling Project (RHP) team will use the robot test cell for robot based First Wall and Shiel Blocks installation strategies development purposes.

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1 Preamble

This Technical Specification is to be read with the General Management Specification for Service and Supply (GM3S) [AD1] that constitutes a full part of the technical requirements.

If conflicts arise, the content of the Technical Specification supersedes the content of the GM3S.

2 Purpose

This document details the technical specifications necessary for the purchase of a heavy duty (HD) robot for the development of a robot test cell. The ITER Organization (IO) Remote Handling Project (RHP) team will use the robot test cell for robot based First Wall and Shield Blocks installation strategies development purposes.

The context of this document is to highlight the main requirements for the procurement of the said HD robot, such as dimensions (compared with the annex that will host the robot), payloads, installation, connections, and safety.

Moreover, this document will list the main deliverables required for the procurement of this HD robot (i.e. technical datasheets, installation and maintenance manuals, drawings, analysis, payloads, software and electrical interfaces).

It is worth noting that from *Figure* 1, for the HD robot we referred to the model FANUC M2000ia/1700L as example for geometry and dimensions constraints.

Figure 1 shows the most demanding scenario for the HD robot in terms of payload, however the said robot will be used also for testing other end-effectors and components, such as the Dual Arm Manipulator.

Figure 2 highlights the boundary conditions of the robot test cell, the control cubicle, the tooling and the manipulator test cells, comparing their dimensions with the ones of the hosting annex.

A safety fence (in red) will surround the robot test cell.

The system must be provided with emergency stops.

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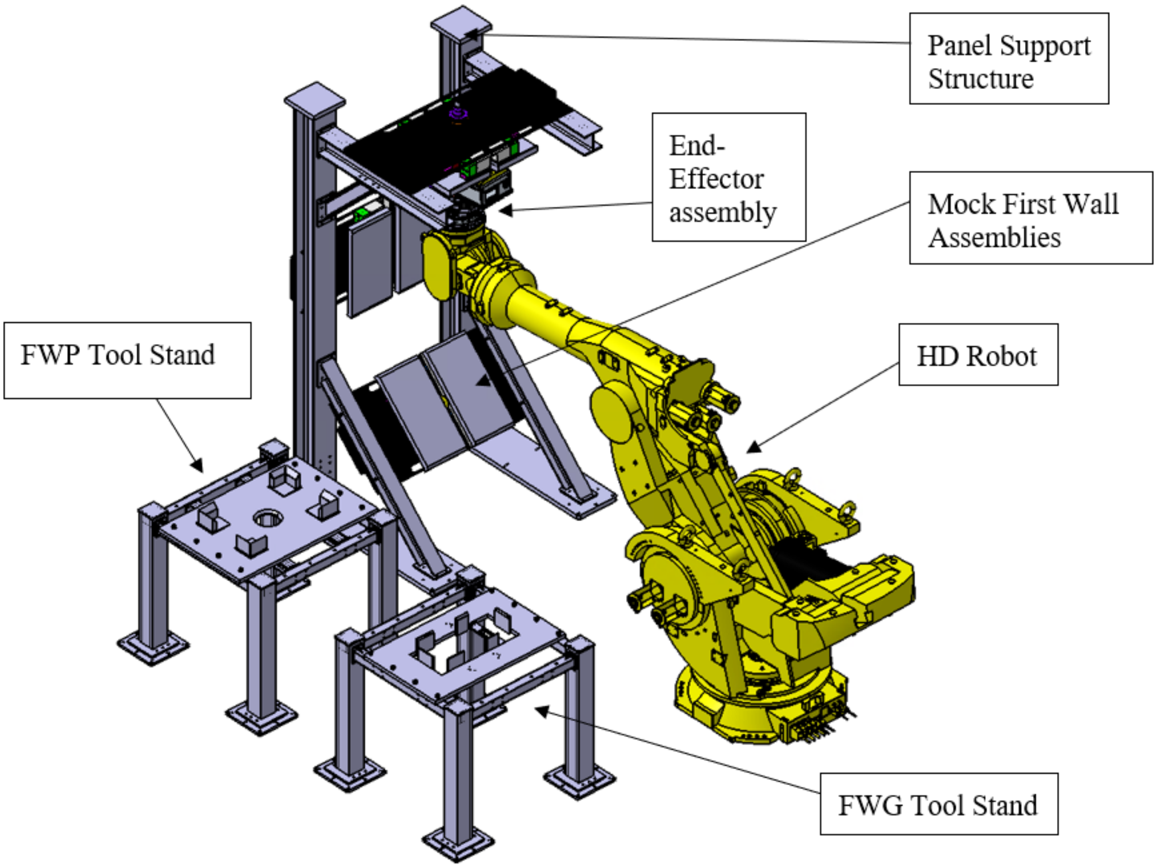

Figure 1 – Robot test cell's components overview (note: the structures around the robot are for context illustration only and out of scope for this Technical Specification).

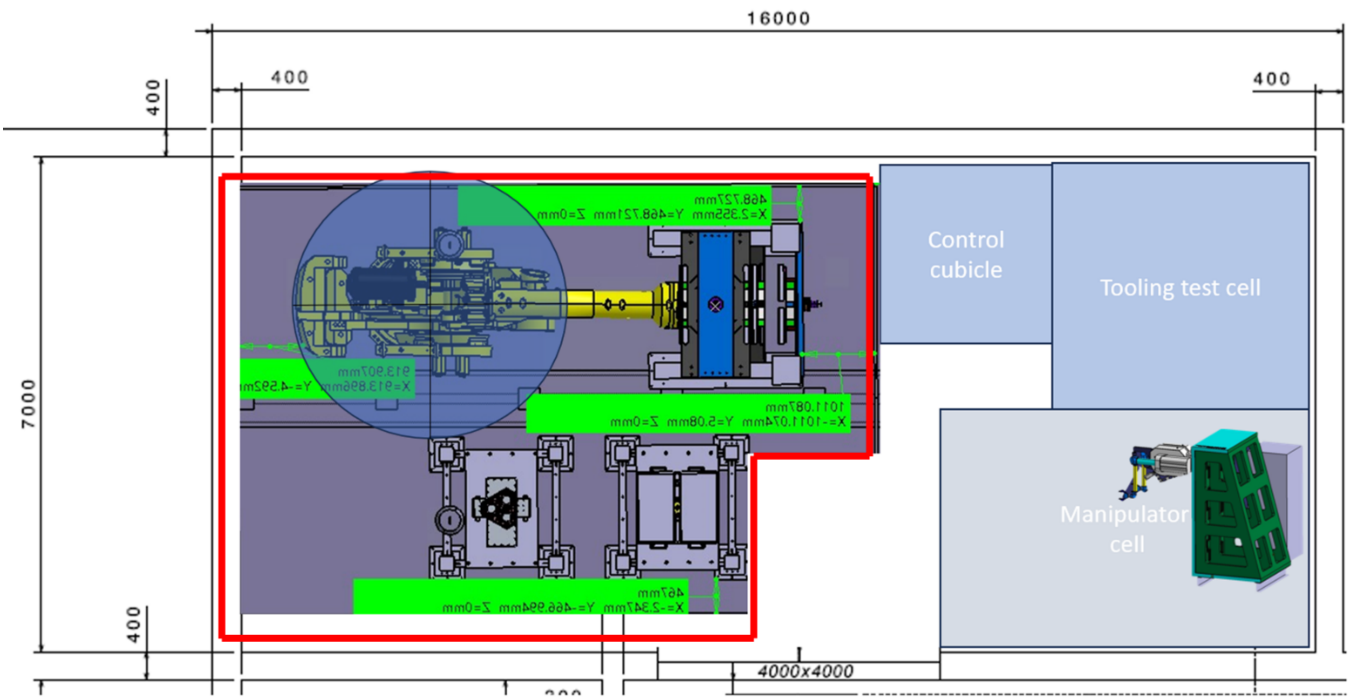

Figure 2 - Top view for the robot test cell and the layout of the control cubicle, the tooling test cell and the manipulator cell. In red, the protection fences that surround the robot cell.

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are relevant to this document.

Abbreviation	Description
BRHS	Blanket Remote Handling System
CMP	Contract Management Plan
CoG	Centre of Gravity
CRO	Contract Responsible Officer
DRR	Delivery Readiness Review
FA	Flange Adaptor
FAT	Factory Acceptance Test
FWG	First Wall Gripper
FWP	First Wall Panel
GM3S	General Management Specification for Service and Supply
HD	Heavy Duty
IDM	ITER Document Management
ILM RO	Integrated Logistics & Materials Responsible Officer
IO	ITER Organization
MTO	Material Take Off
PPE	Personal Protective Equipment
PRO	Procurement Responsible Officer
QC	Quality Class
RHS	Remote Handling Systems
SSC	Structures, Systems, and Components
TAP	Tokamak Assembly Preparation
TC	Tool Changer

3.2 Definitions

B22 TAP Building: building on the IO Site that will house the robot test cell.

Contractor: an economic operator who have signed the Contract in which this document is referenced.

Robot test cell: a secure environment within the TAP Building where IO can test robot procedures, tooling, and designs in a controlled space.

Site or ITER Site or IO Site: the construction site and areas under operation. This includes any place IO staff operates on a regular basis if specified by the IO.

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4 Applicable Documents & Codes and Standards

4.1 Applicable Documents

The Contractor is responsible for identifying and requesting any documents that are not transmitted by IO, including the below list of applicable documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, the Contractor must seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 4 weeks of any impact on the contract execution. No impact will be considered without any response during this 4-week notification period.

The following table details the applicable documents along with their IDM IDs, versions, and titles.

Ref	Title	IDM ID	Version
AD1.	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
AD2.	Internal Regulations	27WDZW	3.1
AD3.	Procedure for the Design Office Activities Related to CAD Data Exchange	2NCULZ	3.1
AD4.	Procedure for the Usage of the ITER CAD Manual	2F6FTX	1.1
AD5.	Requirements for Producing a Quality Plan	22MFMW	4.0
AD6.	Requirements for Producing an Inspection Plan	22MDZD	3.7
AD7.	Requirements for Producing a Contractors Release Note	22F52F	5.0
AD8.	Working Instruction for the Delivery Readiness Review (DRR)	X3NEGB	2.0
AD9.	Procedure for Transportation of Components to ITER site	RY5C6Q	3.1
AD10.	Procedure for Reception of Components at the ITER Site	RXCTBZ	3.2

4.2 Applicable Codes and Standards

The Contractor must procure and follow the relevant Codes and Standards applicable to the project. If the relevant Codes and Standards require the Contractor to produce any documentation, the Contractor must share that documentation with IO.

Ref	Title	Doc Ref.	Version
CS1.	Safety Requirements for Industrial Robots: Robot Systems and Integration	ISO 10218 – 2	2011
CS2.	Low-voltage electrical installations	NF C15-100 IEC 60364	
CS3.	Operations on electrical installations - Electrical risk prevention	NF C18-510	

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4.3 IO Reference Documents

Under this scope of work, IO will deliver the following documents applicable to the project. If the Contractor

Ref	Title	IDM ID	Version
RD1.	Contractor Release Note Template	QVEKNQ	3.1
RD2.	Package & Packing List Template	XBZLNG	2.2
RD3.	TAPB GENERAL ARRANGEMENT DRAWING	V7FQ75	3.3
RD4.	ITER Electrical Design Handbook Codes & Standards	3AG7WN	1.0

5 Overview of the Layout of robot test cell

5.1.1 Description

This section focuses on the layout of the of robot test cell for which such technical specification is realised. RHS was allotted 106 m^2 within the level B1 of the B22 TAP Building for testing [RD3]. Minimizing the robot test cell's footprint is important to give more room for other RHS testing endeavors. Also, the robot test cell components must be within the robot's reach but not too close to where the robot's movements are unnecessarily constrained.

5.1.2 Layout Description

This section describes the foreseen robot test cell's layout:

- To fit the entire robot test cell within the RHS' 106 m^2 room in B1 level - B22 TAP Building (Figure 2) and for safety margin, the HD robot's arm movements will be restrained by the Contractor to a defined amplitude.
- Every component's base lies on B22 TAP Building's floor.
- The HD robot is secured directly on B22 TAP Building's floor according to the robot specifications.
- The Contractor shall propose joint limitations to restrict the working zone, to avoid contact between the walls and ceiling and the robot (minimum distance of 500mm from the robot's wrist/flange).
- Space around the robot will be added so the operators can easily access it for maintenance or repair.
- Extra space will be kept for external support parts like a generator or air compressor.
- The control cubicle will be outside of the robot cell and will be connected by electrical cables with a maximum length of 20m.

6 Scope of Work

The following technical specification's scope of work includes:

1. Procurement of the robot, delivery, and installation in IO B22 facility,
2. Realisation of the safety analysis and procurement of the fences, safety elements (door lock, emergency stop, enabling button, signals lamps…) and associated cabling, delivery, and installation in IO B22 facility,
3. Design, procurement, and integration of the flange adaptor onto the robot,
4. Design, procurement, and integration of the cable management system onto HD robot.

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6.1 Scope of supply #1: Procurement of the robot, delivery, and installation in IO B22 facility

6.1.1 Description

This section outlines the steps for the choice, procurement, and installation of the required HD robot. It is the Contractor's responsibility to order, deliver, and install the robot for RHS' robot test cell. The Contractor must inform IO if any Sub-Contractors are needed during this process and declare them as part of their initial commercial offer.

6.1.2 Mechanical requirements

6.1.2.1 Payload

This section describes the main mechanical requirements of the robot in terms of payload and distance from the robot tool's flange to the CoG (Center of Gravity) of the attached tools under the most demanding scenario.

The robot shall be chosen to be able to carry defined loads below in any possible configuration without any limitation (except slow speed and low acceleration)

The most demanding payload that the robot must carry is the First Wall Panel.

To handle such component, the robot will need an intermediate assembly, the so-called End-Effector assembly. The End-Effector assembly is composed of a Flange Adaptor (FA) - (in the scope of this present specification), that connects the robot to the rest of the End-Effector assembly (out of scope): a Force/Torque Sensor to collect force and torque data, the Tool Changer (TC) to connect to the robot to the primary tool, and the BRHS primary tool.

In this scenario, the BRHS primary tool is the First Wall Gripper that allows First Wall Panel handling.

Table 1 shows the data about mass and distance to CoG for system composed by the End-Effector assembly and the First Wall Panel .

It also should be noted that, for safety reasons, the HD robot will be used at low-speed (below 250 mm/s) and low acceleration levels during its use.

	Mass (kg)	Distance from robot end-effector to CoG (m)
Flange Adaptor (FA)	66.41	0.0025
Force/Torque Sensor	76.00	0.120
Tool Changer (TC)	189.00	0.318
First Wall Gripper (FWG)	235.00	0.572
First Wall Panel (FWP)	1200.00	0.681
Total of the system	1771.41	0.579

Table 1 – Payload data for the system representing the most demanding scenario for the robot.

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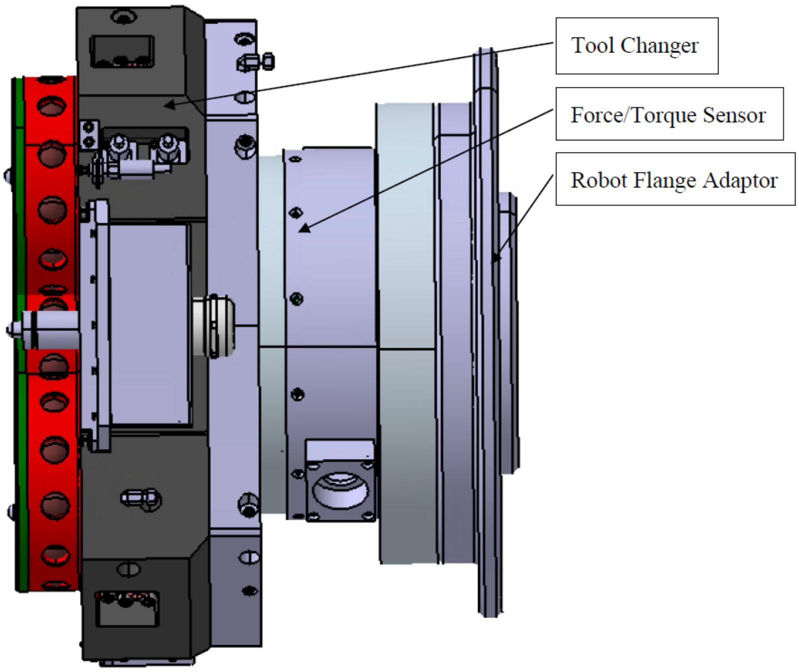

Figure 3 – Side view of the End-Effector assembly.

6.1.2.2 Reach

The robot should able to reach with its tools any point located with any orientation into a cubic workspace of 5mx6.75mx4.1m (Width x Length x Height) while being located at 3.6 and 2.7 mm from the bottom left of such workspace (Figure 4 and Figure 5)

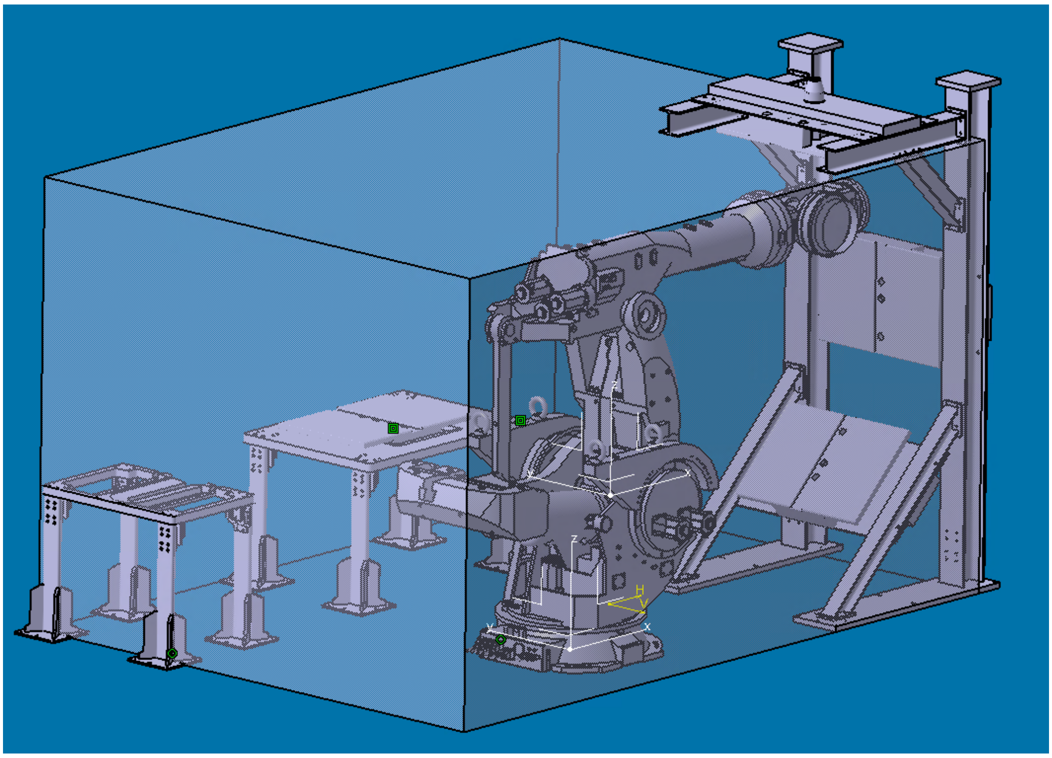

Figure 4: View of the usable workspace for the robot in the test cell

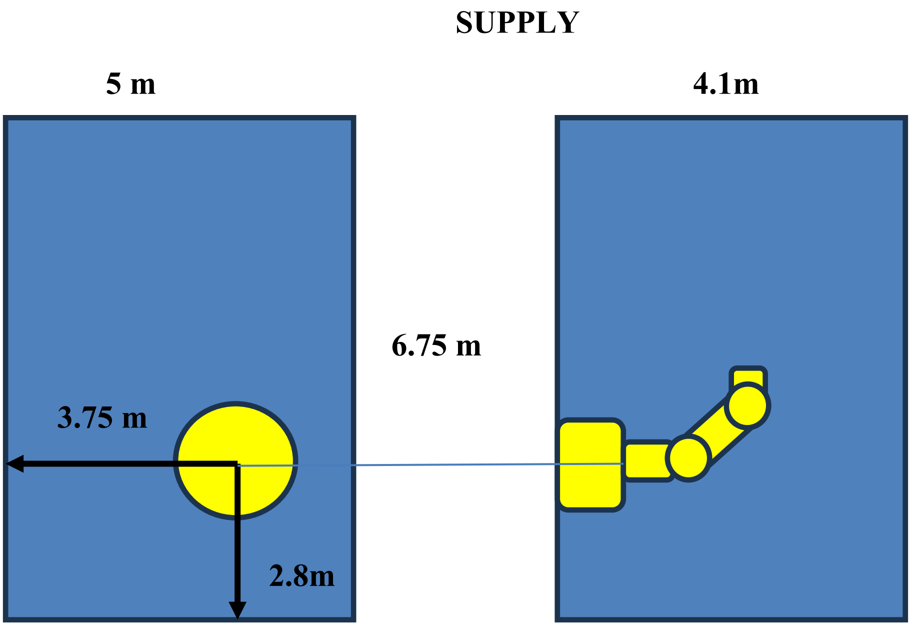

Figure 5: Main dimensions of usable workspace for the robot top view (left) and side view (right)

6.1.3 Electrical Requirements

The Contractor shall make all electrical connections from the power supply in B22 to the robot controller and to the robot, including all required grounding connection as per robot manufacturer recommendations.

IO will provide associated socket/connection for electrical power connection, at a location agreed between IO and the Contractor to allow proper routing of the power cables to the robot controller considering the robot cell layout.

IO will provide electrical power supply protection as per Contractor specifications based on robot manufacturer recommendations and safety analysis.

Grounding continuity shall be tested from to the robot to the power supply connection.

6.1.1 Network / communication requirements.

The force sensor mounted on the robot will be used to adjust the robot position to allow proper connection of the tool changer onto the tools and to allow gripping of the objects to be handled by the tool (*Figure 6*).

For this purpose, the tool changer is wired to a signal conditioner/reader that send the forces and moment values to an industrial PC.

Additional calculations are run in the PC to allow for the robot to receive forces and moments in the robot tool frame to correct its position. Robot position's will also be sent from the robot controller to the industrial PC.

The robot will also communicate with a supervisory control system to receive trajectory parameters, starts stop and resume order (….) and send back general information, such as its current position and status.

Communication protocol shall be TCP/IP or UDP over ethernet.

The Contractor shall provide the required network interfaces on the robot to allow such 2 ways communication between the PCs and the robot controller.

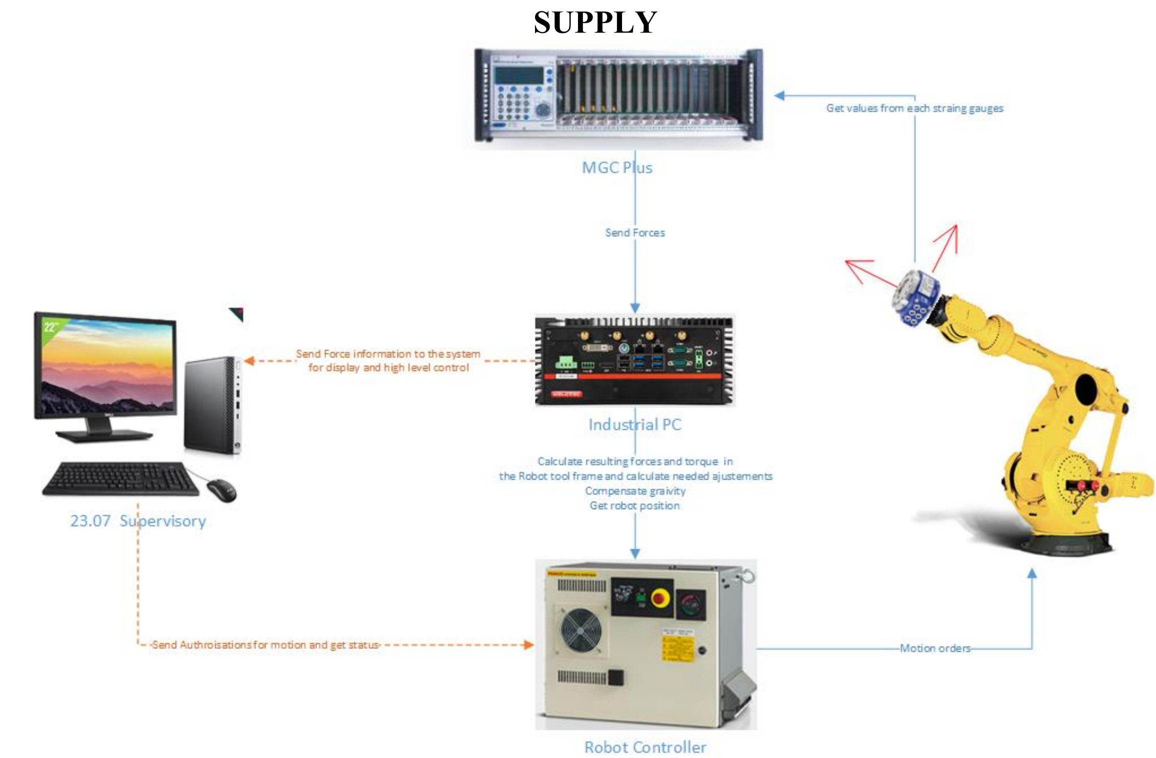

Figure 6: Robot Force control architecture

Similar connections will be used later to allow communication between the robot and camera system for robot vision control.

Definition and realisation of such communication scheme (software) is out of scope of the present technical specification.

6.1.2 Inputs output signals management requirements

6.1.2.1 Safety signals

Choice of input, output, or dry contacts on the robot shall be part of the safety assessment as explain in chapter 6.2.

6.1.2.2 Digitals IO

16 digital inputs and 16 digital outputs (24 V) shall be available on the robot to drive pneumatic electro valves or get digital signals from the tools such as contacts sensors for example.

6.1.2.3 Analog IO

4 Analog inputs [0, +10V] shall be available on the robot for monitoring signals such as distance measurement.

6.1.3 Robot programming and control requirement

The robot shall be provided with a teach pendant to allow manual control/jogging of the robot and programming. The Cable length should be at least 20 m.

Separately from the teach pendant, a robot mode selector (Manual, T1, AUTO, AUTO remote) shall be provided and shall be installed outside the work cell. Such robot mode selector shall be secured with a key.

The Contractor shall also provide an offline programming and simulation software.

The Contractor shall propose (option) any software solution package that he thinks could be needed for the use of the robot as defined in the current technical specification.

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6.1.4 Installation requirements

This section covers all installation requirements for the robot:

1. Installation process must follow robot manufacturer's guidelines if applicable.
2. All installation procedures will be performed by experienced and trained operators.
3. Contractor must perform start-up testing to confirm all robot systems operate correctly.
4. Appropriate safety measures are taken during installation process.

Prior to any installation, as the building is made with heavy reinforced concreate, the ITER Organization will conduct a survey of concreate reinforcement bars in the slab. Such survey will be done using FERROSCAN solution, which is able to define areas where drilling is possible.

The Contractor shall adapt the installation features of the robot according to the FERROSCAN measurement data output.

As an example, below are shown the installation requirements of a FANUC 2000 iA/1700 L robot of the work to be done.

Manufacturer recommends the robot to be anchored to the floor using a floor plate. Said floor plate is installed on the concrete floor surface and fastened with M20 (tensile strength 400N/mm^2 or more) chemical anchors. The floor plate should be fastened to the robot base using M20x75 (tensile strength 1200N/mm^2 or more).
After positioning the robot, the base plate will be welded to the floor plate.

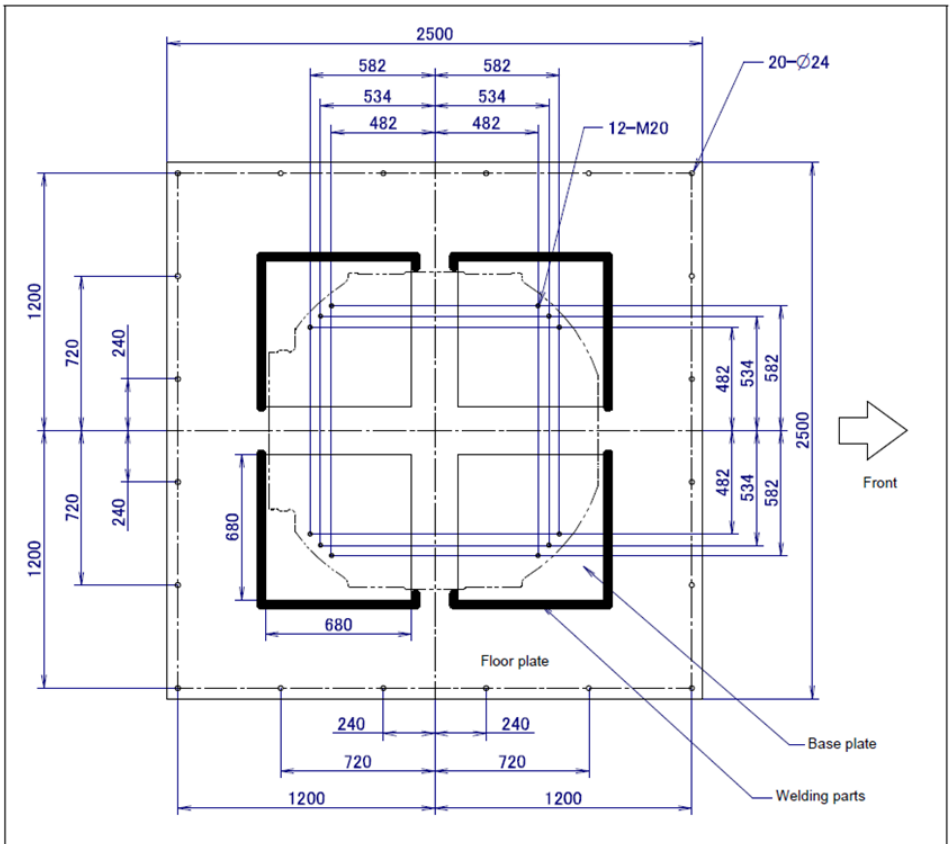

Figure 7 – Floor plate dimensions.

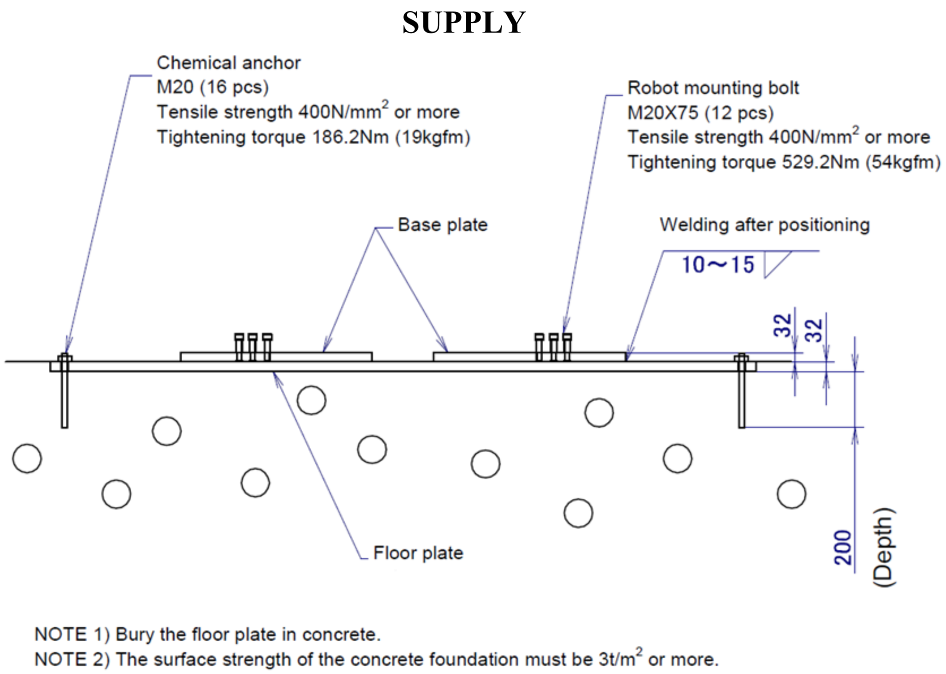

Figure 8 – FANUC 2000iA/1700L Installation method.

This installation shall be modified depending on the robot that is finally chosen.
If the Contractor wishes to (or needs) to derogate from robot manufacturer guidelines, detailed justifications and associated calculations of fasteners, mechanical parts and so on shall be provided and agreed by IO before starting any installation work.
It is to be noted that given that the TAP Building is a nuclear building, and in accordance with its design parameters, drilling into the concrete is limited. So, installation of robot shall be designed and realized according to this constraint, in close relation with IO team.

6.1.5 Documentation

The Contractor must provide a user/operator's manual for the selected HD robot.

Installation, operation, and maintenance of the HD robot must follow the said user manual provided by the Contractor.

If the Contractor is willing to derogate from robot manufacturer guidelines, detailed justifications and associated calculations shall be described in a dedicated document.

6.2 Scope of supply #2: Realisation of the safety analyses and procurement of the fences, safety elements and associated cabling, delivery, and installation in IO B22 facility

6.2.1 Description

This section outlines the steps for the choice, procurement, and installation of the required safety elements of the robot cell. It is the Contractor's responsibility to order, deliver, and install such elements in the robot test cell. The Contractor must inform IO if any Sub-Contractors are needed during this process and declare them as part of their Commercial Offer.

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The Contractor shall realize first the safety assessment according to Ref CS1, robot manufacturer guidelines and additional safety requirement defined in chapter 6.2.2 an operation requirement defined in chapter 6.2.3. . The Contractor shall define the associated safety elements including fences, safety cell entry and exit management, emergency stops, enable switches, light signals…

Fences shall be installed all around the robot cell to prevent any access at a defined distance from robot workspace. A general drawing of the foreseen layout of the work cell will be provided by IO for the Contractor to define the fences' locations and extension.

The Contractor shall determine and implement joint limitations to restrict the workspace so that the robot will not collide with the surrounding environment (ceiling, walls, fences) with an additional margin of 500 mm.

6.2.2 Safety Requirements

This section lists the robot test cell's safety requirements. Additionally, refer to the documents listed in Section 4.2 "Additional Codes and Standards" for in-depth safety requirements according to ISO standards.

1. Robot test cell complies with ISO 11161 and 10218 standards.
2. Comprehensive safety analysis is to be completed for the robot and surrounding equipment in compliance with ISO 12100
3. Robot's path will avoid any surrounding structures.
4. The robot will be always operated with low speed and the system will provide an emergency stop.
5. Only authorized users will access the robot test cell.
6. Only one single authorized controller will operate the robot.
7. A safety perimeter is defined with a fencing installed around the robot test cell.
8. A set of signal lights located at safety perimeter entrance has red, yellow, and green light options.
    a. The red-light alerts user that robot is still moving, and gate is locked.
    b. The yellow light indicates robot has received "stop" commands and is powering down.
    c. The green light indicates robot is inactive, gate is unlocked, and users can safely enter robot test cell.
9. According to the safety assessment's output, elements such as laser detectors within the robot test cell may be used to scan the area and detect human movement. If activated, the Robot is automatically disabled (TBC).
10. Robot always powered off completely for maintenance activities.
11. Electrical wiring must comply with NF C15-100
12. Operation on such electrical wiring and connection to power supply must be done by qualified personal according to French standard NF C18-510

6.2.3 Operating Requirements

This section lists the robot test cell's operating requirements.

1. Robot motion is only enabled when operators are outside the robot test cell.
2. Two operators must be present when any operator needs to enter the robot test cell for maintenance, inspection, or other needed activities.

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6.2.4 Electrical Requirements

1. The Contractor shall realise all electrical connections from the safety elements to the robot controller as per robot manufacturer recommendations.
2. If additional safety systems other than the ones included in the safety management system of the robot controller and identified during the safety assessment are needed, they shall be procured, and installed by the Contractor.
3. Any associated element such as additional power supply, safety network management, cabinet, (…) shall be defined, procured, and installed by the Contractor.
4. Wirring continuity shall be tested for all the connection realised.

6.2.5 Installation requirements

This section covers all installation requirements for the robot:

1. Installation process must follow robot manufacturers' guidelines if applicable.
2. All installation procedures will be performed by experienced and trained operators.
3. Contractor must perform start-up testing to confirm all systems operate correctly.
4. Appropriate safety measures are taken during installation process.

If the Contractor wishes to derogate from manufacturer guidelines, detailed justifications and associated calculation of fasteners, mechanical parts… shall be provided and agreed by IO before any installation work.
The Contractor will have to manage all cables from the robot controller to the various safety element on the floor and/or the fences and route them so that they do not create additional safety risk and allow ergonomics works.
Cables on the floor shall be laydown away from any pathway or any place from where an operator could walk or stand. If it is not possible, such cable shall be protected by cable covers and marked so that then can be clearly seen.

Prior to any installation on the building floor, as the building is made with heavy reinforced concreate, a survey of concreate reinforcement bars in the slab will be done by ITER Organization. Such survey using FERROSCAN solution allows to define areas where drilling is possible.

The Contractor shall adapt the installation features of the fences accordingly.

6.2.6 Documentation

The Contractor must provide any document produced during this scope of work #2, including:

- As built fences drawing,
- As built electrical diagrams,
- User manual describing:
    a. The risk assessment realized,
    b. The protection measures and how to use them,
    c. All associated documentation,
    d. …

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6.3 Scope of supply #3: Design, procurement, and integration of the flange adaptor onto the robot

6.3.1 Description

This section outlines the steps for the design and procurement of the required flange adaptor. It is the Contractor's responsibility to order, deliver, and install such element in the robot tool flange (integration is part of scope of supply #4).

The Contractor must inform IO if any Sub-Contractors are needed during this process and declare them as part of their Commercial Offer.

6.3.1 Mechanical Requirements

The flange shall be designed so that it allows to connect to the robot's tool flange on one side and to the force sensor on the other side (*Figure 9*).

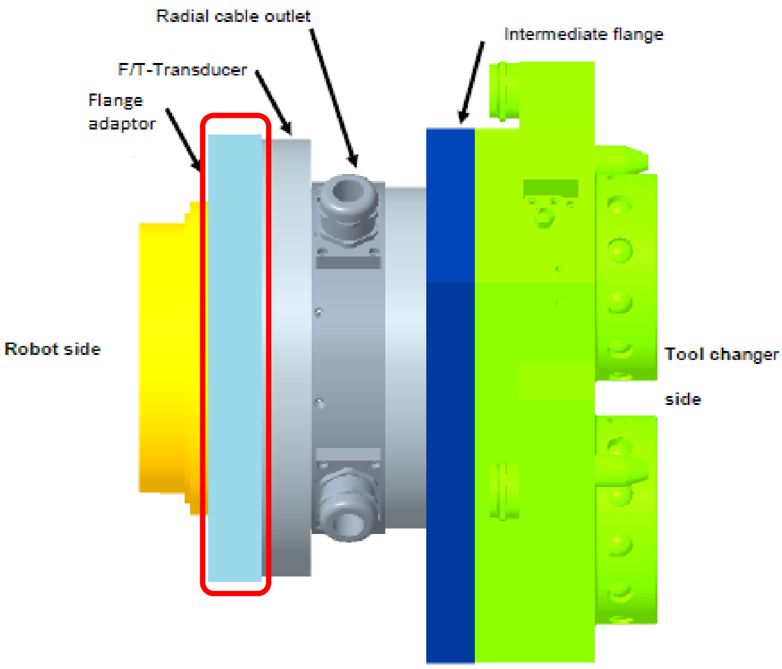

Figure 9 - Flange adaptor connection (circled in red).

Design of the flange shall be done to allow accurate positioning of the tools onto the robot's tool flange so that the tool center point can be accurately known. Localization onto reference cylindrical surfaces with uses of dowel pins shall be used.

On the force sensor side, localization of the tool flange shall be done through (see *Figure* 10, for further details, please refer to the drawing Ahlswede, MPZ2201039_FW_F/T_Transducer):

- Reference planar surface A,
- Reference cylinder B Diameter 215 H8,
- Reference C : Dowel pin 10H7 localized at 150 mm from the force senor main axis (in bottom view).

The design of the flange shall be submitted to IO for approval before its manufacturing

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Appropriate number, resistance class and size of fasteners shall be determined for connection onto the robot's tool flange according to robot manufacturer recommendation and tool flange design.

Appropriate length of fasteners shall be determined for connection onto the flange adaptor design. Force sensor manufacturer has selected 24 x M20 BUMAX DX129 screws (equivalent strength class of 12.9) in Ø365 implantation diameter.

6.3.1 Documentation

The Contractor shall provide ITER Organization with:

- As built mechanical diagrams
- Torques to be applied on the fasteners.
- Assembly procedure (if needed)

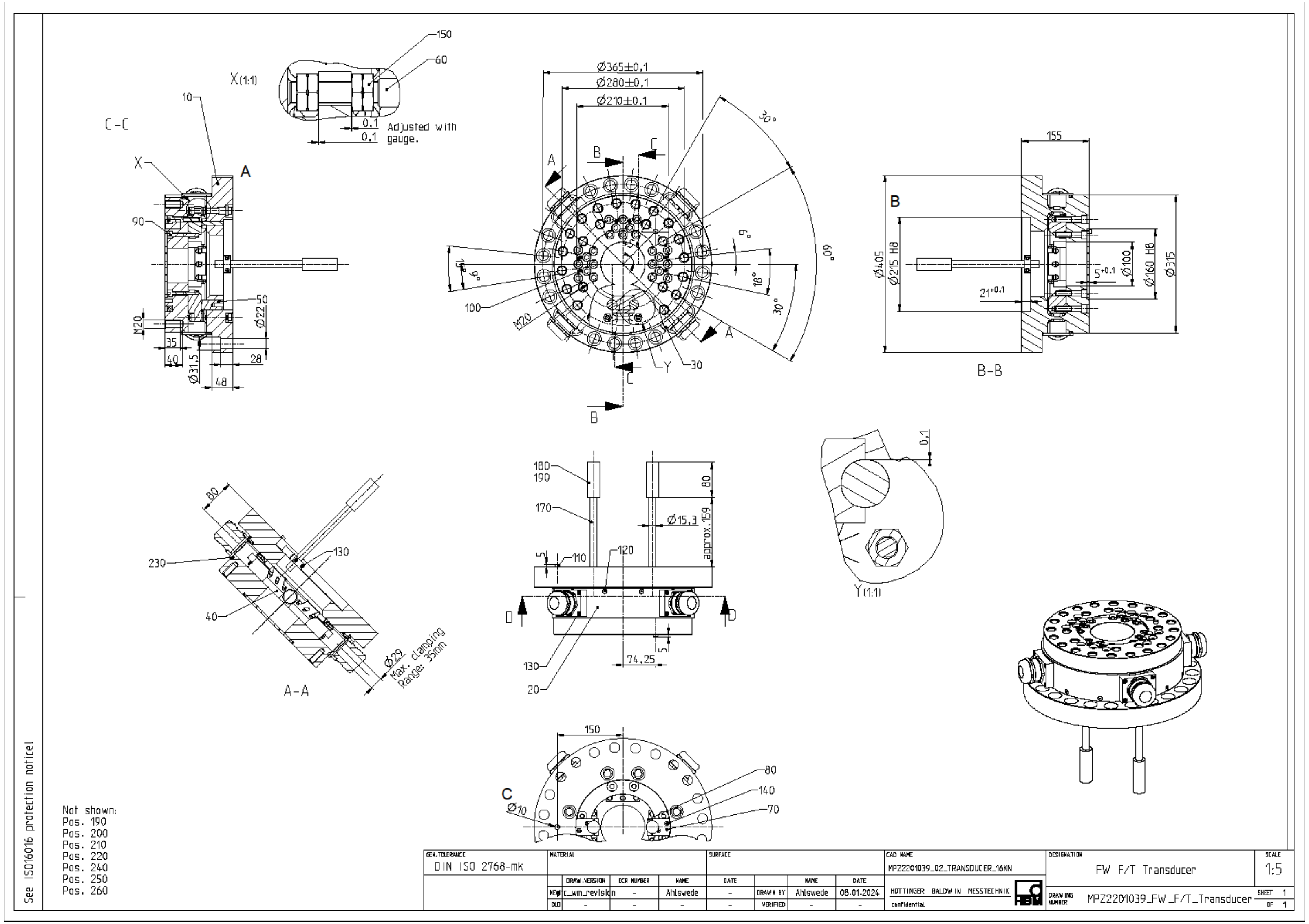

Figure 10 - Force sensor design drawing.

6.4 Scope of supply # 4: Design, procurement, and integration of the cable management system onto HD robot.

6.4.1 Description

This section outlines the steps for the choice, procurement, and installation of the cable management on the robot. It is the Contractor's responsibility to order, deliver, and install such element on the robot test cell (the cables are out of scope of this Technical Specification). The Contractor must inform IO if any Sub-Contractors are needed during this process.

6.4.1 Mechanical Requirements

According to the total cross section of the cables to route to the tool changer (to be defined by IO and provided to the Contractor, order of magnitude of the cable bundle is 70 mm Outer Diameter), the Contractor shall choose and procure such cable management solution such as the one seen in Figure *11*.

This solution shall not limit the robot motion neither add any torque on the joints.

Distribution of the different weights along the robot shall be checked according to the robot capability defined by the robot's manufacturer.

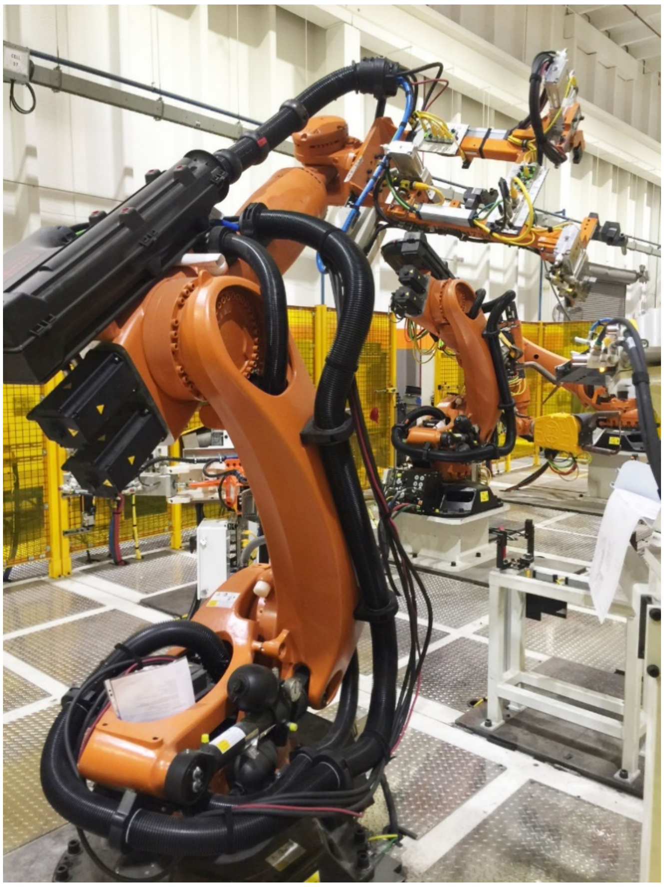

Figure 11: Example of cable management solution.

Attachment of the cables hose onto the tool flange shall be chosen so that the cables can he easily routed from the tool changer connectors with bending radius above 250 mm.

6.4.2 Documentation

The Contractor shall provide ITER Organization with:

- As built mechanical diagrams
- Assembly procedure (if needed)

7 Robot test cell assembly and integration

7.1 Description

This section outlines the requirements surrounding component delivery, installation, and integration in B22 TAP Building. Further requirements surrounding transportation and delivery, customs and export control, start-up and commissioning, and general requirements for work at the ITER site can be found in [AD1].

7.2 On site commissioning (SAT) Requirements

This section lists the robot test cell's commissioning (Site acceptance Test) requirements.

The Contractor shall provide a FAT procedure demonstrating the compliance of the proposed solution with this technical specification's requirements. It shall cover all aspects described in the document including:

1. Electrical connections inspected and tested.
2. Access points inspected and tested.
3. Safety systems integration inspected and tested.
4. Mechanical systems integration inspected and tested.

The SAT procedure shall be developed by the Contractor and supplied to IO at least 3 weeks prior to the tests for approval.
The SAT shall take place at the ITER site and be witnessed by the IO nominated personnel.
Each test of the SAT procedure shall have clearly defined acceptance criteria.
The measured values, as well as the 'pass' or 'fail' outcome shall be recorded for each SAT test in the SAT report for IO to finalise the acceptance of the items provided. In case of partial failure of the SAT, the IO-CRO shall decide the extent to which the SAT needs to be re-done (partial or full).

7.3 ITER Site Access Requirements

This section lists the robot test cell's site integration requirements:

1. All Contractor personal has site access approval two weeks prior to site integration procedures.
2. All Contractor personal undergoes site safety training seminar and passes IO site safety requirements as required.
3. All equipment is delivered to IO site two weeks prior to integration procedures.
4. All Contractor personal park in nearest B22 parking lot
5. All Contractor personal issued IO site access badge.
6. All Contractor personals comply with on-site PPE use regulations.
7. All Contractor delivery vehicles comply with IO site-access regulations.

7.4 ITER Delivery Requirements

This section lists the robot test cell's delivery requirements.

The system is packed and shipped to the IO premises. Preparation for such shipment shall be made with IO collaboration and according to the defined procedure [AD9]. On arrival to ITER site it will be received and inspected [AD10] for provisional acceptance.

Robot test cell components have to be delivered to and assembled in B22 TAP Building at the IO work site, refer to *Figure* 12 and *Figure* 13.

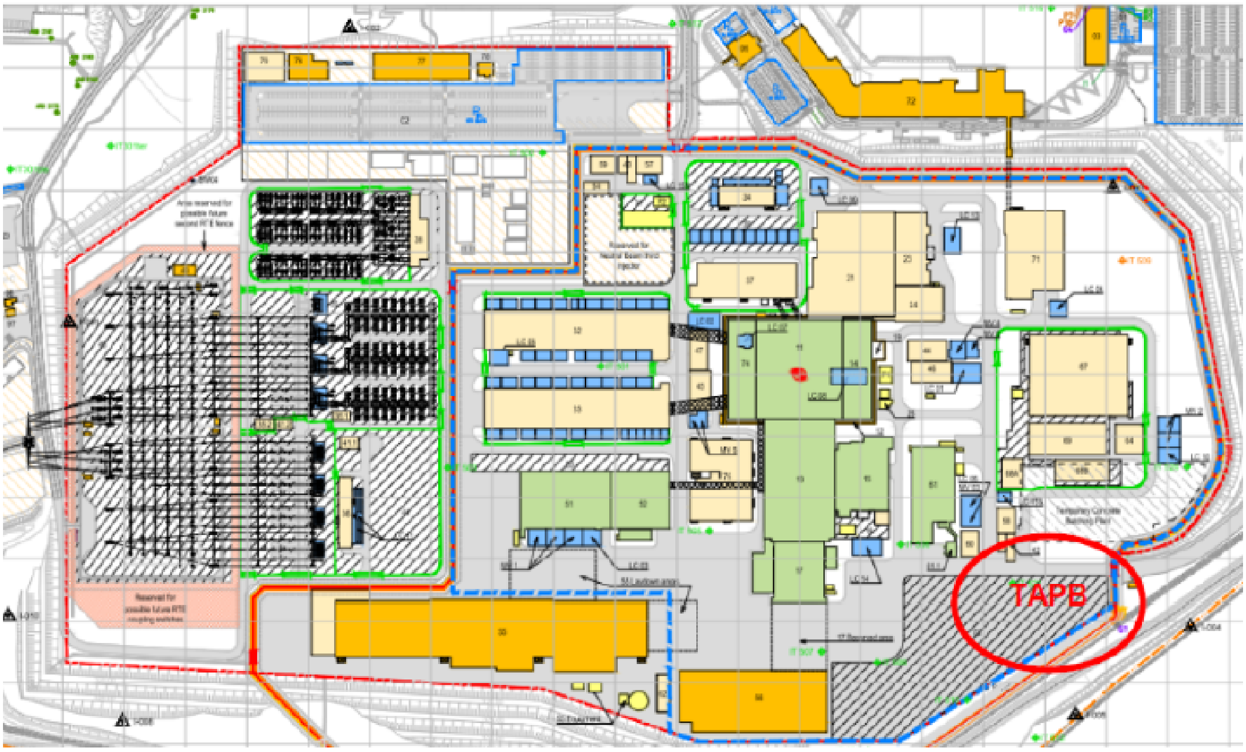

Figure 12 - ITER Site Map showing location of the B22 TAP Building.

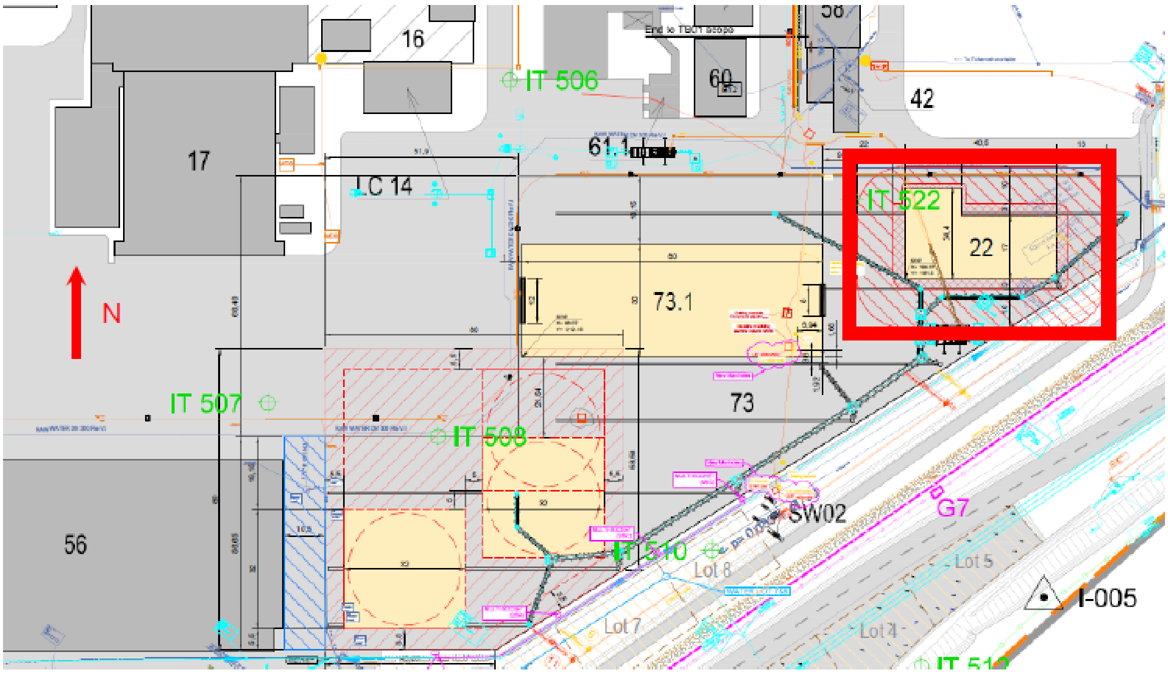

Figure 13 - ITER Site Map showing location of the B22 TAP Building.

All robot test cell component shipments must be accompanied by a Delivery Report (cf. chapter 13.1.2.2 prepared by the Contractor with the following information:

1. Packing Date
2. Full Delivery Address
3. Full Name of Receiver
4. Full Name of Supplier
5. Full Supplier's Address
6. Bill of Materials
7. Security Measures
8. Release Note
9. Packing List
10. Declaration of Package's Integrity

The Contractor must take appropriate insurance against risk of loss or damage to parts during transport.

The Contractor must transport all deliverable elements required by this technical specification document from factory to its delivery point inside IO premisses where it shall be inspected for partial acceptance (cf. chapter 7.4) .

The robot test cell's components will be transferred from the its delivery point to it final location inside the building using ITER Global Logistic Provider (DAHER), considering B22 constraints, e.g. obstacles, lift payload and dimensions.

Only this transfer operation inside the building will be directly managed by ITER Organization.

8 Location for Scope of Work Execution

The Contractor can perform the design and manufacturing work at their own location. However, all components must be delivered to IO headquarters and assembled onsite. The Contractor must ensure its employees have the necessary access permissions to the IO worksite for installing the Robot test cell's final electrical, mechanical, and control systems (cf. chapter 7.3).

IO headquarters is located in southern France close to the city of Aix-en-Provence. IO headquarters' address is : Route de Vinon de Verdon, 13115 Saint-Paul-lez-Durance, France. All components must be delivered to IO headquarters, and the Contractor is responsible for coordinating transport logistics for onsite assembly, refer to chapter 7.4 for further details.

9 IO Documents & IO Free Issue Items

The following list of free issue items will be provided by the IO.

9.1 Free Issue Items

N/A

10 List of Deliverables

The Contractor shall provide IO with the documents and data required in the application of this technical specification, the [AD1] and any other requirement derived from the application of the contract.

You can find here below a minimum list of documents that are required within the expected timing:

Deliverable number	Deliverable	Expected Timing (T0+x) *
D0	Quality plan	T0 + 2
D1	Kick Off Meeting Minutes	T0 + 2
D2	Final design report and approved minutes of FDR for scope of work #1,2,34, covering all elements listed in chapters 6.1.5,6.2.6,6.3.1 and 6.4.2, to be provided 3 weeks before FDR date	T0 +20
D3	Delivery Readiness Review Documentation Pack	T0 + 24
D4	Delivery and installation of the elements listed in the present tech spec	T0 + 26
D5	SAT procedure (see chapter 7.2)	T0 + 26
D6	SAT test report (see chapter 7.2)	T0 + 32
	Close – Out	T0 + 34

(*) T0 = Commencement Date of the contract; x in weeks.

Supplier shall prepare their document schedule based on the above and using the template available in the [AD1] appendix II.

11 Quality Assurance Requirements

The Quality class under this contract is QC3 (Quality Class), [AD1] Section 8 applies in line with the defined Quality Class.

The Contractor must have an ITER approved QA program or an ISO 9001 accredited quality system. The Contractor must submit for IO approval a Quality Plan according to ITER's quality plan requirements [AD5]

12 Safety Requirements

The contractor shall refer to [AD1] Section 13 for general requirements for working at ITER Site

12.1 Nuclear Class Safety

No specific safety requirement related to PIC and/or PIA and/or PE/NPE components apply.

12.2 Seismic Class

No specific design requirement against seismic solicitations applies.

13 Specific General Management Requirements

Requirement for [AD1] Section 6 applies amended with the below specific requirements.

13.1 Contract Gates

In addition to the contract gates as defined in [AD1] Section 6.1.5, the scope of work call for Contract Gates as defined in Section 5. Also refer to, the deliverables and due dates outlined in Section 8.

13.1.1Kick-Off Meeting (kick off meeting)

The project's kick off meeting is the contract's first contract gate and serve to:

- Confirm the scope of each task.
- Update the Contractor on previous work.
- Confirm that both parties have all reference documentation.
- Answer any questions either party may have about the deliverables.

The Contractor and IO-RH will agree on the kick off meeting's date. The kick off meeting may take place online via videoconference or in person.

The Contractor will provide the meeting agenda, presentation, and summary minutes.

The Contractor shall submit the following documents as a minimum for the kick off meeting:

- Quality Plan
- Contract Management Plan

13.1.2 FDR (Final Design Review), DRR (Delivery Readiness Review), and SAT (Site Acceptance Test)

13.1.2.1 FDR

The Contractor shall complete an FDR (Final Design Review). During a meeting organised by IO, with a panel of IO members, the Contractor shall present its design work, explaining the design process, the calculations realised if any and all information's needed to justify the design choice.

IO members may ask for further explanation and justification and/or modification of the design.

Such modification shall then be realised before delivery of the components at ITER site.

13.1.2.2 DRR (Delivery Readiness Review)

The purpose of the DRR is to review and validate Contractor's documents, as developed in [AD8]

- CRN, template in Appendix VII
- Delivery Report, template in Appendix XIII
- Native-file Packing List, template in Appendix XII
- Lifting, handling, and/or Packing procedures or requirements
- and/or any other technical or logistical information that is needed so that the material can be adequately managed through transportation, reception, storage, preservation and ultimately into ITER construction and assembly.

No shipment is allowed without a successful DRR.

Please refer to [AD1] Section 9 that further develops the logistics requirements.

13.1.2.3 SAT (Site Acceptance Test),

See chapter 7.2

13.1.3 Close Out

The close-out phase will entail a final check from both parties that the technical specifications have been met, the RHP team is prepared to take responsibility of the system, and that all contractual obligations have been fulfilled.

13.2 Work Monitoring

Before work begins, the Contractor must get approval from IO on a Contract Management Plan (CMP). This CMP will outline the Contractor's standard project procedures and address control activities like:

- Contract planning and scheduling,
- Progress Monitoring,
- Cost Management,
- Risk Management.

The Contractor must subdivide the work into work packages (WBS) and provide a plan on how to deliver the WBS according to the specified milestones.

The Contractor must provide a progress monitoring plan based on the WBS list with deliverables with defined completion criteria.

The Contractor must provide cost estimates for any specification changes as well as a "Change Log" listing all non-conformities and deviation requests submitted to IO for review.

13.3 Meeting Schedule

RHS and Contractor will establish a regular meeting schedule which may take place either in person or via video conference.

Meetings will follow a typical format:

- Detect and correct any issues that may cause delays.
- Review any completed and planned activities.
- Assess the contract's progress.
- Bring any unexpected problems to quick and agreed upon solutions.
- Answer questions that either party may have about specifications.

Meeting minutes will be taken every time and will be provided by the Contractor. The Contractor shall prepare a meeting summary report based on the minutes and is to be submitted at minimum one (1) week prior to next meeting with IO. See Section 13.2, "Work Monitoring" and [AD1] GM3S Section 6.1.6 for further details.

13.4 Data Management

IO's document library, IDM, will be accessible to the Contractor for information storage. All data entered into the IDM will be kept confidential according to IO policy.

Formal document submission completed by uploading documents to project's IO IDM folder along with a formal email to IO-CRO.

All contract documents shall be written in English and include project reference designations.

Uploaded documents must include the original editable version along with most recent version in PDF format with MS Office 2007 or higher compatibility.

Standard document review cycle includes:

- IO will have ten (10) working days from the receipt of Contractor's Documents to review, comment on and/or, as the case may be, approve them. If after 10 days the Contractor has received any approval or comments from IO, the Contractor shall contact IO by phone to discuss the status of the documents. In addition, if after 10 days the situation is such that the approval procedure delays the project, the Contractor shall formally inform IO in writing.

  Note: For some documents, a period longer than 10 days might be required for review. In such situation, IO shall inform the Contractor and a longer period shall be commonly agreed.
- The Contractor shall have eight (8) working days from the receipt of commented documents to update and resubmit them to IO.
- The IO will have five (5) working days to review the updated documents.

13.5 CAD Design Requirements

IO-RH is creating and managing the CAD files of the robotic cell in such a way that the CAD design requirements described in [AD1] are satisfied.

The contractor is requested to submit the native 3D CAD models produced in the frame of this contract to IO (CATIA V5 preferred), DWG for 2D drawings and associated STEP files.

The Contractor will have access to ENOVIA to reference RHS' current designs.

13.6 Responsibilities

13.6.1 IO Responsibilities

IO shall share all technical data and documentation the Contractor requires to fulfil its obligations in the manner and time outlined in this contract. For delays of more than two weeks, the Contractor shall advise IO-CRO how the delay will impact subtask delivery and agree on corrective actions.

13.6.2 CRO

IO shall designate one ITER Organization Contract Responsible Officer (IO-CRO) to interface between IO and Contractor on management, technical, and logistical functions.

IO-CRO is tasked with:

- Assessing Contractor's works' performance and quality.
- Ensuring all necessary data is shared with the Contractor.
- Responding to Contractor information requests.
- Monitoring the project's process and problem resolutions.
- Verifying that the deliverables fulfil the IO requirements.