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Technical Specifications (In-Cash Procurement)

Development and manufacturing of AR Coating for Diagnostics' Windows

Open Tender for:

The purpose of this document is to provide the technical specifications for the:Design of different AR coatings for diagnostic's Quartz, Sapphire and ZnSE windowsQualification of the AR coatings against the environmental conditions and bonding processDelivery of coated samples to allow IO to perform qualification tests on AR coated samples (tests on irradiation effects and slow crack growth exponent of the fused silica material)AR coated discs for in series production

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1 Purpose

The purpose of this document is to provide the technical specifications for the:

- Design of different AR coatings for diagnostic's Quartz, Sapphire and ZnSE windows
- Qualification of the AR coatings against the environmental conditions and bonding process
- Delivery of coated samples to allow IO to perform qualification tests on AR coated samples (tests on irradiation effects and slow crack growth exponent of the fused silica material)
- AR coated discs for in series production

Each window assemblies is composed by:

- A structural body provided with a bolted flange, for the mechanical and vacuum tight attachment on a vacuum extension also called "mating flange".
- Two transparent discs (with or without an Anti-reflective coating, depending on optical requirements from each system) assembled into metallic ferrules by aluminium diffusion bonding.
- An interspace volume between both discs, whose pressure is permanently monitored by the Service Vacuum System (SVS).

An example of a Sapphire window can be seen in Figure 1.

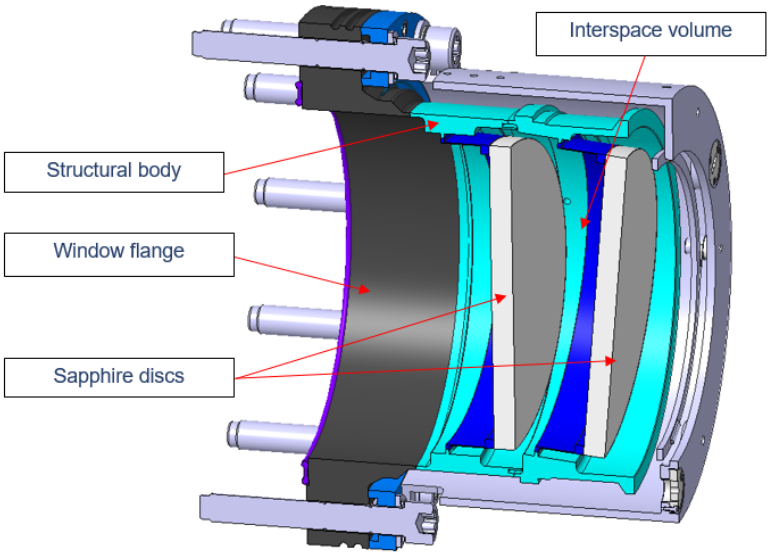

Figure 1: Section of Window Assembly

2 Scope

Several diagnostic systems incorporating Fused Silica window assemblies plan to make use of anti-reflection (AR) coatings to improve the transmission performances of the optics. This Task Order is aimed at developing, qualifying and supplying such coatings.

It is not under the scope of this contract the qualification under neutron/gamma irradiation, nevertheless the materials used for the AR coating will be chosen with previous agreement with IO in order to minimize the risk of high activation and delamination of the coating

The scope of work covered in this specification is to:

1. Development and Qualification of AR coating
    a. Development of AR coating for, Quartz, Sapphire and ZnSe windows
    b. Qualification of AR coating against bonding of windows, 550ºC for 4 hours (300ºC and 2 hours for ZnSe)
    c. Qualification of AR coating against environmental conditions such as thermal cycling and Lost of coolant accident events (validation against radiation damage will be assessed by ITER Organization)
2. AR coating for the qualification and in-series production of windows for diagnostics
    a. Coating of beams for mechanical testing (note that mechanical test is outside scope of this contract)
    b. Coating of disks to be used for manufacturing of windows

Quartz, Sapphire and ZnSe disks and beams for qualification and in-series production will be free-issued by IO.

3 Definitions

AoI: Angle of Incidence

AR: Anti reflection

DA: Domestic Agency

FWHM: Full with at half maximum

HP: Hold Point

IO: ITER Organization

IO-TRO: ITER Organization technical Responsible Officer.

RT: Room Temperature

SSD: See System Design

WA: Window Assembly

For a complete list of ITER abbreviations see: ITER Abbreviations (ITER_D_2MU6W5).

4 References

Ref	Title	IDM link
[R1]	ITER Procurement Quality Requirements	ITER_D_22MFG4
[R2]	Requirements for Producing a Quality Plan	ITER_D_22MFMW
[R3]	System Design Description (DDD) 55.NW Windows	ITER_D_46NXUU
[R4]	Cat2-#28-Outgassing-requirement-resolution-memo	ITER_D_2S6JQM
[R5]	Appendix C20 Product Procurement Specifications Sapphire Disc	ITER_D_3QQF43
[R6]	Appendix C21 Product Procurement Specifications Quartz Disc	ITER_D_3QQKJR
[R7]	ITER Vacuum Handbook	ITER_D_2EZ9UM
[R8]	IS 55.NW-55	UDS88X
[R9]	Sub-System Requirement Document sSRD-55.NW: Windows	ITER_D_WYWVMP

[R10]	55.NW System Loads Specifications for Quartz Windows	ITER_D_XLC4VW
[R11]	55.NW System Loads Specifications For Sapphire Windows	ITER_D_XLCJWV

5 Estimated Duration

The duration shall be for 42 months. No work shall commence prior to the date of final signature of the Contract.

6 Work Description

Several diagnostic systems making use of windows call for AR-coated windows to improve the transmission performances.

6.1 Design of different AR coatings

[RQ-001] When the specifications of the discs call for an antireflection coating, this shall apply to both sides of the discs.

[RQ-002] The detailed drawings specify the extent of the coated area. Beyond the coated area up to the edge of the discs, the surface shall be protected from any pollution caused by the coating deposition. This is essential to ensure the quality of the bonding during the next steps of the window assembly production.

[RQ-003] A detailed masking process shall be submitted for prior acceptance to the IO.

[RQ-004] (Optional) In case the requirements from the ITER diagnostic systems evolve or the AR coating qualification fails, there will be the possibility to develop one extra coating system per material

6.1.1 Anti-Reflection Coating for Quartz

6.1.1.1 Anti-Reflection Performances

[RQ-005] The coating system #1 (CS#1-Q) shall meet the transmission performances given in Table 1.

Table 1: transmission performances of coating system CS#1-Q

Wavelength	Optical reflectivity per face	Angle of incidence
300 to 450 nm	R < 1 % (mandatory)	0 - 5°
300 to 450 nm	R < 0.3% (desirable)	0 - 5°

6.1.1.2 Environmental requirements (normal conditions)

[RQ-006] The transmission performances of all coating systems specified in § 6.1.1.1shall be kept under the environmental conditions defined in the present sub-section.

[RQ-007] The coating systems shall be able to withstand compression / extension strains (specified in Table 2) induced by the overall deformations of the disk under different pressure conditions.

- 0 MPa / 0.05 MPa / 0.1 MPa (normal conditions).

- 0.2 MPa (accidental conditions).
- 0.3 MPa (factory acceptance test)

Table 2: maximum principal strains of the top and bottom surfaces of the disc, induced by the deformation of the disc under pressure

	Ø 82 mm CV
ΔP = 0.05 MPa (30 cycles)	0.6 x 10^{-5} mm/mm
ΔP = 0.1 MPa (10 cycles)	1.2 x 10^{-5} mm/mm
ΔP = 0.3 MPa (1 cycle)	3.6 x 10^{-5} mm/mm

[RQ-008] Coated discs shall withstand the temperature conditions listed below.

- Manufacture process (once) : 550°C during a few hours.
- Baking of the machine (100[1] cycles) : Ramp up from 20°C to 200°C in 44 hours. Cooling up to ambient in 44 hours.
- Operational temperature (20 years) : 50 ~ 70°C.
- Plasma shots (5 000 cycles[1]) : Ramp up from 50 ~70 °C to maximum 145°C within 60 seconds. Cooling up to 50 ~70°C within 1200 seconds.

The overall deformations of the coated surfaces of the disc assembled in the metallic ferrule are driven by the thermal expansion of the Quartz substrate. Given the thermal expansion coefficient of Quartz substrate (13.2 x 10^{-6} $°C^{-1}$), the extension strains induced by the increase in temperature is specified in the Table 3.

Table 3: principal extension strains of the surfaces on which the coating is applied.

	Extension strain
Manufacture process (550°C) once	7.00 x 10^{-3} mm/mm
Baking (500 cycles)	2.11 x 10^{-3} mm/mm
Plasma shots (30 000 cycles)	1.25 x 10^{-3} mm/mm

Note that the performances of the coating system shall be ensured only during the non-nuclear phase, since the diagnostic system requiring the use of this coating is no longer operational after the non-nuclear phase.

[1] The total number of baking cycles is 500 during ITER lifetime. The number of baking cycles during the non-nuclear phase is limited to 100 cycles. The number of plasma shots is limited for the same reason.

6.1.2 Anti-Reflection Coating for Sapphire

6.1.2.1 Anti-Reflection Performances

[RQ-009] The coating system #1 (CS#1-S) shall meet the transmission performances given in Table 4.

Table 4: transmission performances of coating system CS#1-S

Wavelength	Optical reflectivity per face	Angle of incidence
400 to 730 nm	R < 2%	0-10°
3 to 4.5 µm	R < 1%	0-10°

[RQ-010] The coating system #2 (CS#2-S) shall meet the transmission performances given in Table 5.

Table 5: transmission performances of coating system CS#2-S

Wavelength	Optical reflectivity per face	Angle of incidence
1.22 to 1.3 µm	R < 12%	0-4°
1.3 to 2.5 µm	R <2.5	0-4°
2.5 to 4.6 µm	R <1.5	0-4°
4.6 to 4.7 µm	R <2.0	0-4°

6.1.2.2 Environmental requirements (normal conditions)

[RQ-011] The transmission performances of the coating system specified in § 6.1.2.1 shall be kept under the environmental conditions defined in the present sub-section.

[RQ-012] The coating system shall be able to withstand compression / extension strains (specified in Table 2) induced by the overall deformations of the disk under different pressure conditions.

- 0 MPa / 0.05 MPa / 0.1 MPa (normal conditions).
- 0.2 MPa (accidental conditions).
- 0.3 MPa (factory acceptance test)

Table 6: maximum principal strains of the top and bottom surfaces of the disc, induced by the deformation of the disc under pressure

	Ø 130 mm CV	Ø 160 mm CV
ΔP = 0.05 MPa (30 cycles)	0.5 x 10^{-5} mm/mm	1.5 x 10^{-5} mm/mm
ΔP = 0.1 MPa (10 cycles)	2.0 x 10^{-5} mm/mm	3.0 x 10^{-5} mm/mm
ΔP = 0.3 MPa (1 cycle)	6.0 x 10^{-5} mm/mm	9.0 x 10^{-5} mm/mm

[RQ-013] Coated discs shall withstand the temperature conditions listed below.

- Manufacture process (once) : 550°C during a few hours.
- Baking of the machine (500 cycles) : Ramp up from 20°C to 180°C in 44 hours. Cooling up to ambient in 44 hours.
- Operational temperature (20 years) : 50 ~ 70°C.

- Plasma shots (30 000 cycles) : Ramp up from 50 ~70 °C to maximum 145°C within 60 seconds. Cooling up to 50 ~70°C within 1200 seconds.

The overall deformations of the coated surfaces of the disc assembled in the metallic ferrule are driven by the thermal expansion of the Sapphire substrate. Given the thermal expansion coefficient of Sapphire substrate (6.85×10^{-6} °C^{-1}), the extension strains induced by the increase in temperature is specified in Table 7.

Table 7: principal extension strains of the surfaces on which the coating is applied.

	Extension strain
Manufacture process (550°C) once	3.29×10^{-3} mm/mm
Baking (500 cycles)	1.1×10^{-3} mm/mm
Plasma shots (30 000 cycles)	6.51×10^{-4} mm/mm

[RQ-014] The coating shall not be affected by the nuclear radiations specified in [R10].

6.1.2.3 Laser induced damage threshold

[RQ-015] The disc N°1 will transmit high power laser signal. The specifications of the laser loads are specified in the present section. These specifications shall apply to coated disks.

[RQ-016] The disc N°1 shall withstand the laser loads specified in Table 8. The damage threshold is the maximal crack size as the result of a damage either in the bulk or on the rear or the front surface of the disc. The maximal crack size shall be less than 10 microns after the total number of pulses.

Table 8: Laser load – 55.GL

Effective pulse duration	Continuous laser
Frequency	Continuous laser
Wavelength	800 nm
Beam diameter	Ø26 mm
Peak power at window level	200 W
Max. power density at window level	0.24 W/cm²
Total number of pulses	One laser pulse every 10 plasma pulses is expected (3000) but 30 000 laser pulses are considered as a conservative approach

[RQ-017] If tests are required to justify the laser damage threshold, the characterization of laser-induced damage threshold shall be carried out according to ISO 21254-1:2011.

6.1.3 Anti-Reflection Coating for ZnSe

6.1.3.1 Anti-Reflection Performances

[RQ-018] The coating system #1 (CS#1-Z) shall meet the transmission performances given in Table 9.

Table 9: transmission performances of coating system CS#1-Z

Wavelength	Optical reflectivity per face	Angle of incidence
4800 nm	R<0.75%	0 – 1°
9600 nm	R<0.75%	0 – 1°

[RQ-019] The coating system #2 (CS#2-Z) shall meet the transmission performances given in Table 10.

Table 10: transmission performances of coating system CS#2-Z

Performance	Wavelength	Optical reflectivity per face	Angle of incidence
Desirable	3 to 6 µm	R<0.25%	0 – 5°
	10.6 µm	R<0.25%	0 – 5°
	637 nm	R<5%	0 – 5°
Mandatory	3 to 6 µm	R<1.5%	0 – 5°
	10.6 µm	R<1.5%	0 – 5°
	637 nm	R<12%	0 – 5°

6.1.3.2 Environmental requirements (normal conditions)

[RQ-020] The transmission performances of the coating system specified in § 6.1.3.1shall be kept under the environmental conditions defined in the present sub-section.

[RQ-021] The coating system shall be able to withstand compression / extension strains to be specified during the KOM

[RQ-022] Coated discs shall withstand the temperature conditions listed below.

- Baking of the machine (500 cycles) : Ramp up from 20°C to 180°C in 44 hours. Cooling up to ambient in 44 hours.
- Operational temperature (20 years) : 50 ~ 70°C.
- Plasma shots (30 000 cycles) : Ramp up from 50 ~70 °C to maximum 145°C within 60 seconds. Cooling up to 50 ~70°C within 1200 seconds.

[RQ-023] The coating shall not be affected by the nuclear radiations specified in [R10].

6.1.4 Environmental requirements (accidental conditions)

[RQ-024] The inner discs of the window assemblies may be exposed to water steam at 300°C inside the vacuum chamber triggering water condensation on the disc, whereas the disc is maintained at 100°C by thermal conduction with the structure. The duration of this event is 196 hours. This event may be repeated 15 times within 20 years. The transmission performances of the coating shall be maintained after these events.

6.1.5 Vacuum outgassing rate requirements

[RQ-025] The outgassing rates of the coating shall be consistent with the values given in the Table 11.

Table 11 : maximum outgassing rate

Maximum steady state Outgassing rate ($Pa.m^3.s^{-1}.m^{-2}$)		
Outgas temperature (°C)	Hydrogen isotopes	Impurities
100	1.10^{-7}	1.10^{-9}

6.1.6 Design of the coating system

[RQ-026] The coating should be applied using an Ion-Assisted source, magnetron sputtering, or Ion Beam Sputtering (IBS), to increase the density of the coating and to avoid any water absorption in the coating. Magnetron sputtering deposition technique should be preferred due to high temperatures and vacuum conditions. However, this shall be the supplier responsibility to define both the coating technique and the coating design, taking into account both the functional and the environmental requirements.

Insofar as the coating system is composed of different layers of different materials, some of these materials may be significantly activated. This could be the case for Tantalum, and Hafnium, even if the layers are very thin.

[RQ-027] The coating system shall therefore be composed of materials, which cannot be much activated under the specified environment.

[RQ-028] The composition of the materials used in the different coating systems shall be submitted to the ITER organization for approval. These pieces of information will be used by the IO, to assess the potential additional activation induced by the coating system. A Non Disclosure Agreement may be signed between the IO and the supplier, to protect the know-how of the supplier.

6.2 Qualification of the AR coating against environmental conditions

[RQ-029] All the cleaning, packing, packaging and control procedures shall be submitted for acceptance to the ITER Organization before starting the qualification phase. In the same way, the qualification program shall be submitted to the ITER Organization for acceptance before starting the qualification phase.

[RQ-030] The coating system shall be qualified against the bonding operation (assembly of the disc into a metallic ferrule by diffusion bonding carried out at 500°C ~ 550°C). For each coating system and disc sizes (see Table 12), spectral measurements in transmission and reflection as well as quality control of the optical quality shall be achieved before bonding and after bonding.

Table 12: qualification tests of the coating system against the bonding operation

Disc	Coating system	Material
Ø 82 mm CV	CS#1-Q	Quartz
Ø 160 mm CV	CS#1-S	Sapphire
Ø 130 mm CV	CS#2-S	Sapphire

Ø 90 mm CV	CS#1-Z	ZnSe
Ø 90 mm CV	CS#2-Z	ZnSe

[RQ-031] The qualification program shall at least include the following tests.

- The outgassing rate measurement: 1 sample for each coating type,
- Abrasion testing, cleaning ability, adhesion testing performed on witnesses,
- Spectral measurements in transmission and reflection, before and after environmental tests.
- Optical surface quality measurement, before and after environmental tests,
- Optical surface quality measurement, before and after coating,
- One thermal cycle mimicking the bonding operations (550°C a few hours), not required for the ZnSe
- Environmental tests, including cycling aging, thermal aging and chemical aging. irradiation testing will be achieved by the ITER Organization.

[RQ-032] The supplier shall provide at least 3 coated beam samples with each different AR coating systems for the irradiation measurements

[RQ-033] Dimension of samples are to be proposed by supplier with 2 constrains in mind:

a. Minimize size to facilitate irradiation program
b. Proper size in order to perform spectral measurements

[RQ-034] The qualification program of the coating shall be submitted to the IO for approval.

IO may guide the supplier towards specific testing facilities, in particular for tests under wet conditions (water steam @ 300°C), cyclic aging and thermal aging.

[RQ-035] The durability tests, the adhesion and abrasion tests have to be done in accordance with either MIL-C-4897A or ISO 9211 series.

[RQ-036] A visual inspection and spectral measurements shall be performed for at least one sample of each coating batch, in order to get a reference measurement.

6.3 AR coating development program

[RQ-037] The development program of the coating systems shall be composed of several phases.

- Phase #1. Design of the different AR coatings. Definition of the technical specifications of the AR coatings based on the preliminary assessment of the transmission performances. Drawing up the qualification program. This phase ends with a design review, aiming at freezing the technical specifications of the different AR coatings. This phase may include preliminary testing, in particular thermal cycle at 550°C to mimic the bonding conditions.

- Phase #2.1. Qualification of the AR coatings against the environmental conditions, and bonding process.

- Phase #2.2. In parallel, delivery of AR coated samples, to allow the IO to perform qualification tests on AR coated samples. The tests foreseen by the IO are aimed at

verifying that the AR coating does not affect the slow crack growth exponent of the material

- Phase #3: AR coated discs for in-series production.

6.4 Factory acceptance

[RQ-038] The supplier factory acceptance procedure shall be submitted to the ITER Organization for acceptance. The acceptance procedure shall at least include:

- Measurement of the optical characteristics over the relevant wavelength range,
- Surface imperfection tolerances measurement in accordance with ISO 10110-7. It shall be carried out for all windows and spread on the whole coated surfaces.
- Adhesion Testing, Abrasion Testing, Cleaning Ability Testing on witnesses for all coating batch.
- Review of the control and inspection reports.

[RQ-039] The following documents shall be delivered to the customer:

- Qualification dossier.
- All control and inspection reports.

6.5 Optical testing / Quality control

[RQ-040] The discs shall be verified by systematic measurements carried out on every pre-form, and polished disc, before or after coating as specified in the Table 13.

Table 13: Manufacture step of the quality control

Requirement (according to ISO 10110)	**Before polishing***	**Before coating***	**After coating**
0 / Birefringence	X	X	
1 / Bubbles and Inclusions	X		
2 / Heterogeneity and striae	X		
3 / Surface form tolerance		X	
5 / Surface texture		X	X
6 / Laser Damage threshold (qualification process), if this cannot be demonstrated by existing data.			X

**Outside scope of this contract*

6.6 Cleanliness

[RQ-041] Cleanliness requirements on the coated discs are defined in ITER_D_WKFAEG - Appendix_C2_Tech-spec-Fused-Silica-Disc-procurement-FDR-version.

6.7 Packaging / Packing / Marking

[RQ-042] Packaging, packing, marking requirement on coated discs are defined in ITER_D_WKFAEG - Appendix_C2_Tech-spec-Fused-Silica-Disc-procurement-FDR-version.

6.8 AR Coated samples quantities for qualification

[RQ-043] For material characterization, the contractor shall deliver to IO the coated samples specified in Table 14

Table 14: Coated Samples for material characterization

Material	Main geometry features	Coating system	Quantity
Quartz	Beam 25 x 2.5 x 2 mm^3	CS#1-Q	50
Sapphire	Beam 25 x 2.5 x 2 mm^3	CS#1-S	50
Sapphire	Beam 25 x 2.5 x 2 mm^3	CS#2-S	50
ZnSe	Beam 25 x 2.5 x 2 mm^3	CS#1-Z	50
ZnSe	Beam 25 x 2.5 x 2 mm^3	CS#2-Z	50

[RQ-044] For optical tests after irradiation, the contractor shall deliver to IO the coated samples specified in Table 15

Table 15: Coated Samples for optical test after irradiation

Material	Main geometry features	Coating system	Quantity
Quartz	Cylinder Ø20 mm x 10 mm	CS#1-Q	5
Sapphire	Cylinder Ø20 mm x 10 mm	CS#1-S	5
Sapphire	Cylinder Ø20 mm x 10 mm	CS#2-S	5
ZnSe	Cylinder Ø20 mm x 10 mm	CS#1-Z	5
ZnSe	Cylinder Ø20 mm x 10 mm	CS#2-Z	5

[RQ-001] For qualification of the AR coating IO shall free issue samples to be coated as specified in Table 16

Table 16: Coated Samples for optical test after irradiation

Material	Main geometry features	Coating system	Quantity
Quartz	Disc Ø 82 mm CV T = 9.8 mm	CS#1-Q	5
Sapphire	Ø 160 mm CV T = 10 mm ±0.1 mm	CS#1-S	5
Sapphire	Ø 130 mm CV T = 10 mm ±0.1 mm	CS#2-S	5
ZnSe	Ø 90 mm CV T = 10 mm	CS#1-Z	5
ZnSe	Ø 90 mm CV T = 10 mm	CS#2-Z	5

AR coated discs for in series production

[RQ-002] Table 17.

Table 17: Coated samples to be delivered

Material	Main geometry features	Coating system	Quantity Batch#01	Quantity Batch#02
Quartz	Ø 82 mm CV T = 10.8 mm	CS#1-Q	7	0
Sapphire	Ø 160 mm CV T = 12 mm ±0.1 mm	CS#1-S	10	40
Sapphire	Ø 130 mm CV T = 12 mm ±0.1 mm	CS#2-S	0	6
ZnSe	Ø 160 mm CV T = 17 mm	CS#1-Z	0	6
ZnSe	Ø 160 mm CV T = 17 mm	CS#2-Z	0	12

7 Responsibilities

1.1 Contractor's Responsibilities

In order to successfully perform the tasks in this Technical Specification, the Contractor shall:

- Strictly implement the IO procedures, instructions and use templates;
- Provide experienced and trained resources to perform the tasks;
- Contractor's personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;
- Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security IO rules.

1.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;
- Organise a monthly meeting(s) on work performed;

8 List of Deliverables and due dates

D#	Description	T0 + x months
D0	Quality plan	T0
WP#01 - Quartz and Sapphire		
D1.1	Optical design of coating systems	2
D1.2	Coating technique specification	3

D#	Description	T0 + x months
D1.3	Manufacturing Inspection Plan (MIP) and Qualification program of AR Coating	7
D1.4	Delivery coated samples for material characterization	8
D1.5	Delivery coated samples for qualification under irradiation	8
D1.6	Qualification of coating system	10
	Hold point 1: Qualification of coating system before manufacturing of coated disks	
D1.7	Delivery of coated disks Batch #01	16
D1.8	Delivery of coated disks Batch #02	42
WP#02 - ZnSe		
D2.1	Optical design of coating systems	4
D2.2	Coating technique specification	6
D2.3	MIP and Qualification program of AR Coating	9
D2.4	Delivery coated samples for material characterization	12
D2.5	Delivery coated samples for qualification under irradiation	12
D2.6	Qualification of coating system	15
	Hold point 2: Qualification of coating system before manufacturing of coated disks	
D2.7	Delivery of disks for manufacturing	24
WP#03 (Optional) – Alternative coating systems		
D3.1	Optical design of coating systems	12
D3.2	Coating technique specification	14
D3.3	MIP and Qualification program of AR Coating	16
D3.4	Delivery coated samples for material characterization	18
D3.5	Delivery coated samples for qualification under irradiation	18
D3.6	Qualification of coating system	22
	Hold point 3: Qualification of coating system before manufacturing of coated disks	
D3.7	Delivery of disks for manufacturing	42

9 Acceptance Criteria

The deliverables will be posted in the Contractor's dedicated folder in IDM, and the acceptance by the IO will be recorded by their approval by the designated IO TRO. These criteria shall be

the basis of acceptance by IO following the successful completion of the services. These will be in the form of reports as indicated in section 8, Table of deliverables.

10 Work Monitoring / Meeting Schedule

Work is monitored through reports (see List of Deliverables, section 8) and at monthly project meetings for each of the projects.

11 Delivery time breakdown

See Section 8 “List Deliverables section and due dates”.

12 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in ITER Procurement Quality Requirements (ITER_D_22MFG4).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with Software qualification policy (ITER_D_KTU8HH).

13 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual (2F6FTX), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings 2DWU2M).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER GNJX6A - Specification for CAD data production in ITER Contracts.). This implies the usage of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet (249WUL) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

14 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 (PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 (AW6JSB v1.0)).

Compliance with Defined requirements for PBS 55 - Diagnostics (NPEVB6 v2.0) or its flowed down requirements in SRD-55 (Diagnostics) from DOORS (28B39L v5.5) is mandatory.

This task is a PIA.

“The supplier must comply with the all requirements expressed in “Provisions for implementation of the generic safety requirements by the external actors/interveners” (SBSTBM)”