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Preface

In 2011 the first version of the General Specification for the FAIR accelerator complex has been released. A small group has been mandated to revise the General Specifications in 2013/2014.

The revision group thanks the authors of the previous versions for their great work and is particularly grateful to the experts for their input, comments, and fruitful discussions.

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1. Introduction

FAIR, Facility for Antiproton and Ion Research is a new multipurpose accelerator facility for the research with antiprotons and ions. The FAIR accelerator complex provides beams of antiprotons and ions with highest intensities, energies, and power in brilliant quality and for parallel operation. In consequence, FAIR will provide worldwide unique accelerator and experimental facilities allowing for a large variety of unprecedented fore-front research in physics and applied science.

2. Definitions

2.1 Definitions

The contracting body is either the GSI GmbH or the FAIR GmbH defined as the **"Company"**.

The **"Contractor"** is the provider in case of an in-kind contribution (IKC) or a commercial company, identified by the tendering process, hereinafter referred to as the "Contractor".

The **"contract"** is concluded between the Company and the Contractor. In case of an in-kind contribution the shareholder is a third contracting party

2.2 Classifications of Requirements[1]

"Shall" or **"has to"** or **"must"** or **"is required to"** are used to indicate mandatory requirements, strictly to be followed in order to conform to the standard and from which no deviation is permitted.

"Shall not" or **"must not"** means that the definition is an absolute prohibition of the specification.

"Should" or **"is recommended"** is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others or that a certain course of action is preferred but not required.

"Should not" or **"is not recommended"** means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighted before implementing any behaviour described with this label.

"May" or "might", which is equivalent to **"is permitted"**, is used to indicate a course of action permissible within the limits of the standard.

2.3 Systematic of Specifications

A **"Detailed Specification"** specifies the purpose of the component, its detailed features, and information to design and produce it.

[1] See also http://standards.ieee.org/develop/policies/opman/sect6.html

A **"Common Specification"** is a set of definitions, prescriptions and rules valid for a technical system (e.g. the magnets, the vacuum system or the cryogenic system). It covers common technical aspects.

The **"General Specifications"** is a comprehensive set of definitions, prescriptions and rules, which is valid for all accelerators and storage rings, technical systems and components of the FAIR project. It covers mainly administrative and organizational topics, e.g. general aspects of safety and quality assurance.

"Technical Guidelines" specify rules of technical aspects which have to be respected by correspondent technical systems.

The ranking of the documents is specified in the contract.

3. Legal Requirements, Standards and Internal Regulations for Safety

3.1 Legal Requirements

3.1.1 The applicable law has to be adhered. In particular but not exclusively it is referred to the laws and directives in Annex I.[2]

3.1.2 The Contractor has to declare, that his deliveries and duties comply with the legal requirements.

3.1.3 The Company has the right to verify if the Contractor complies with the legal requirements. In case of identified deficiencies the Contractor commits himself immediately and free of charge to eliminate them.

3.1.4 A CE declaration of conformity is required, unless German law allows different confirmations. In this latter case compliance with German standards is compulsive.

3.2 General German Safety Regulations

3.2.1 Relevant rules to be considered are international and German standards (e.g. ISO, IEC, DIN, VDE) and the Berufsgenossenschaftliche Vorschriften (BGV) and are given in particular but not exclusively in Annex II.

3.3 Internal Safety Regulations

3.3.1 General Remarks

3.3.1.1 The regulations regarding the safety of the accelerator and the human being must be followed by the Contractor; they are given in particular but not exclusively in Technical Guidelines and Specifications.

3.3.1.2 The Contractor shall submit in a document latest after fixing the design of components (CDR accepted, milestone S002.M6 in Table 1) all safety relevant data. The document will be checked by the Company's safety office.

[2] Further Information are given online http://bundesrecht.juris.de

3.3.1.3 Every device has to adopt a technically safe state in case of fail function. This comprises the contact safety as well as measures against unintended switch on via the control system. Exceptions have to be agreed upon by the Company.

3.3.1.4 The language for all operating panels must be English (preferred) and German if possible. Solutions for a later translation must be prepared.

3.3.1.5 Warning signs and other safety-critical notes must be in German and in English.

3.3.1.6 Devices installed in highly activated areas shall be removable by means of remote handling.

3.3.4 Remarks for Humans and Environment

3.3.4.1 The radiation safety for humans and environment is subject to the German Radiation Protection Ordinance and in particular to the responsible radiation protection authority which is the Hessian Ministry for Environment, Energy, Agriculture and Consumer Protection (Hessisches Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz).

3.3.4.2 Workers carrying out work at the FAIR accelerator complex at radiation controlled areas must be educated and trained in radiation protection techniques and fulfil the given radiation protection and entrance requirements.

3.3.4.3 For workers of the Contractor or from other external companies the same rules apply as for employees of the Company. In addition with every external company a contract has to be established which settles the apportionment with Company in terms of radiation protection like personal dosimeter, mutual exchange of dose values, instructions and training.

4. General Design Aspects

4.1 Reliability

4.1.1 The FAIR accelerator system is planned to be operated with only few weeks of interruptions per year. The projected lifetime of the system is about 30 years. The components placed in the accelerator tunnels will not be accessible during operation. Even during shutdown time access to components might be very limited due to remaining activation in the tunnels. Intervention time on accelerator components in service rooms will also be very limited.

4.1.2 Therefore, all components shall be rated for continuous operation (up to 6000 operating hours per year with virtually no interruption for 30 years)[3] at all power output levels, taking care of the worst case of mains and environmental conditions and with minimum of maintenance. The Contractor shall therefore rate all components accordingly and use the most appropriate materials.

[3] In this context continuous operation is defined as continuously operating in its standard scheme, this could also be, e.g. a pulsed operation scheme.

4.1.3 All equipment shall be designed in accordance with the best existing techniques and recognize good design practices available at the time of design. In particular the worst-case design principle has to be used, that is, the Contractor shall deliver the risk assessments with the components.

4.2 Design Principles

4.2.1 The Contractor guarantees that the materials used and manufacturing processes are in compliance with the Detailed Specifications, the Common Specifications, the Technical Guidelines, the drawings, and the documentation at all stages of the project.

Provision of material certificates is not sufficient to discharge the Contractor from his guarantee that the materials used is in compliance with specifications.

4.2.2 The metric system is the mandatory system to be used. Exceptions have to be agreed by the Company.

4.2.3 The colours of accelerator magnets are standardized throughout the Company [1].

4.2.4 Materials near the beam pipe shall have a high level of radiation hardness [2].

4.2.5 In general, uncertified semiconductor components shall not be used in the tunnel or other radiation areas.

4.2.6 The mechanical design must comply with the requirements of the Design Guideline [3].

4.2.7 The electrical design must comply with the requirements of the Electrical Design Rules and Regulations [4].

4.2.8 All components connected to the FAIR Ethernet communication network must comply with the technical guideline [5].

4.2.9 All components to be integrated into or connected to the accelerator control system must comply with the standards defined in technical guidelines [6], [7], [8] and the control system Common Specification [9].

4.3 Maintenance

4.3.1 The FAIR is a unique accelerator facility. Scientists from all over the world will use extensively the experimental opportunities at FAIR. The operating costs of such a complex facility are significant. With respect to the international scientific community and the operating costs, not scheduled shutdown times have to be as short as possible.

A significant part of the accelerator complex will be (highly) activated. The safety of the maintenance personnel allows only short time access or remote handling in activated areas.

That means that in general replacement times of components should be minimized.

4.3.2 All components used have to be in batch production and likely to be so for at least the next five years. Commercially available components have to be used wherever possible.

Obsolete or specially selected components shall not be used.

All components and spare parts have to be available at least 10 years. The Contractor has to provide a long term strategy to ensure the availability over required time span.

4.4 Design Report

4.4.1 All technical concepts and designs have to be given in form of a design report to the Company and must be approved by the Company before start of construction.

4.4.2 Any approval of the Company does not impact the responsibility of the Contractor to deliver the components as specified and requested.

4.4.3 The Contractor may at any time suggest modifications to the details as found in the drawings and/or specifications. In each case, the Contractor shall inform the Company and seek for a written approval. The Contractor shall remain responsible for the construction, assembly and delivery in compliance with the specifications.

4.4.4 Any work, modification or change of documentation without approval by the Company is not part of the contract.

5. Quality Assurance

5.1 General Remarks

5.1.1 This chapter defines the general FAIR project quality assurance aspects and test strategy for the accelerator facility project.

5.1.2 The quality plan (Q-Plan) [Annex III] is the basic document to achieve the necessary quality. In the contract the relevant aspects of the Q-Plan might be adjusted.

5.1.3 Further individual and specific aspects and tests are described in the relevant Detailed Specifications, Common Specifications, and Technical Guidelines.

5.1.4 General test specifications and test procedures are described in Chapter 5.3

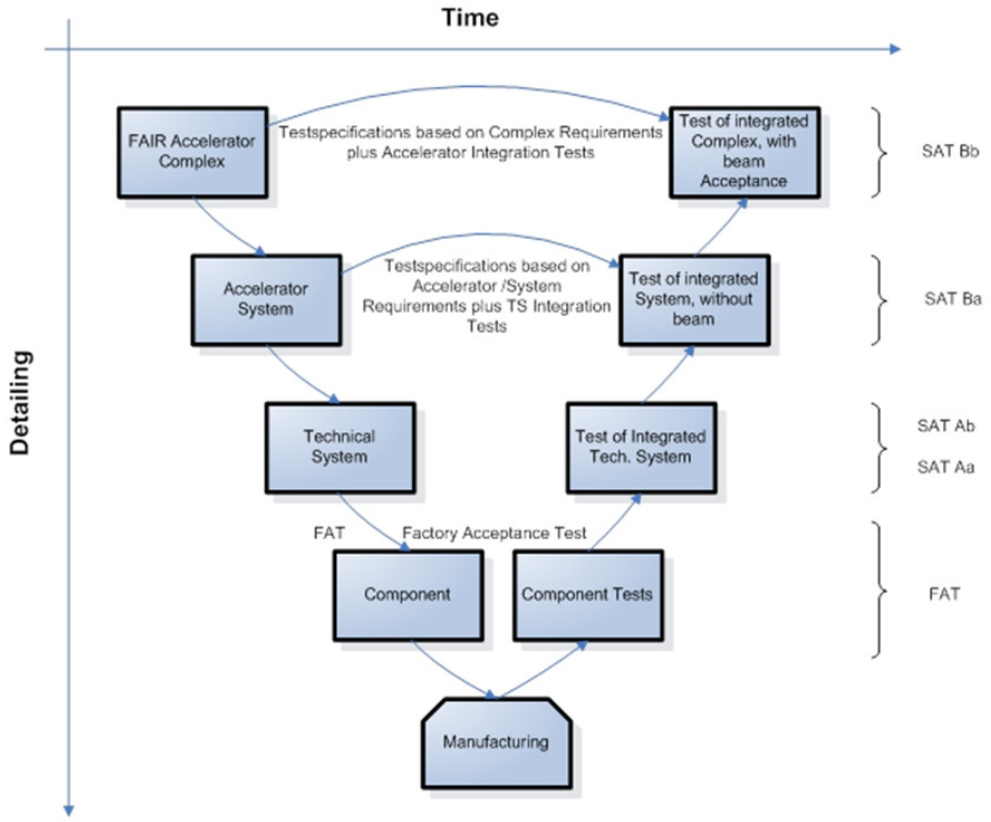

Figure 1: V-Modell for quality assurance and test strategy

5.2 Quality Gates

5.2.1 Defined by the Work Breakdown Structure, the complete accelerator complex is divided into individual accelerator systems. These are made up of various technical systems. The technical systems are built by using a set of components. Quality assurance and test strategy utilises a standard model (c.f. Figure 1).

5.2.2 The next phase in the process can only be started after the acceptance of the previous quality gate[4] by the Company. Quality gates are e.g. the acceptance of the Final Design Review (S002.M7), of the pre-series (S004.M8), of the Factory Acceptance Test (S005.M9), and of the Site Acceptance Tests (S006.M10 and S007.M11). A conditional acceptance is possible.

5.2.3 Tests and quality aspects are defined in the Common Specifications and in the individual Detailed Specifications.

5.2.4 **Factory Acceptance Tests (FAT)** are carried out at the manufacturer's site.

5.2.5 **Site Acceptance Tests (SAT)** at the Company's site are divided into part A and B.

[4] A quality gate is a special milestone in a project which focuses on the achievement of predefined quality goals. Quality gates are located before a phase that is strongly dependent on the outcome of a previous phase.

SAT Part A includes the tests after delivery to the Company, but before the technical system is integrated in its final installation place.

- SAT Aa is the incoming goods inspection
- SAT Ab contains all the other tests to be carried out to get permission for transport to the final installation place

5.2.6 **SAT Part B** comprises all tests to be performed at the final installation place.

- SAT Ba includes all tests without beam
- SAT Bb addresses the tests with beam.

5.2.7 With respect to project milestones and quality gates, the following steps and phases are defined for the FAIR project. If necessary, additional steps will be added in the Detailed Specification of components.

5.2.8 For Schedules the activity codes and sub codes in Table 1 shall be used for each item to be specified. The activity code divides the different tasks in 7 different groups. The sub code assigns a unique activity (A) or milestone (M) to each step.

Activity Code	Sub Code	Description
S002		**Design and planning**
S002	A3	Compile work package description / TDR
S002	M3	Approval of work package description / TDR
S002	A4	Prepare contract
S002	M4	Contract is signed
S002	A5	Prepare manufacturing concept
S002	M5	CD0 = Critical Decision 0
S002	A6	Detailing of the manufacturing concept
S002	M6	CDR accepted
S002	A7	Finalize (manufacturing) documentation
S002	M7	FDR accepted / planning completed
S003		**Production / Procurement**
S003	AX1	Acquire material
S003	MX1	All material is acquired
S004		**Manufacturing of pre-series / prototype**
S004	A8	Manufacturing of pre-series / construction of prototype
S004	A89	Testing of pre-series / prototype
S004	M8	Pre-series accepted / prototype tested
S005		**Manufacturing of series / component**
S005	M81	Series production started
S005	A90	Prepare series production
S005	A91	Execute series production
S005	A99	Execute FAT
S005	M9	FAT accepted
S006		**Shipment to FAIR**
S006	ATS	Shipment to FAIR
S006	A10	Execute SAT Aa
S006	A109	Execute SAT Ab
S006	M10	SAT accepted / approval for installation
S006	M91	Start of Shipment
S006	M92	End of Shipment
S007		**Installation in tunnel / cave**
S007	A110	Transport into tunnel / to experimental site
S007	A112	Assembly of components
S007	A119	Execute SAT Ba / test without beam

S007	M11	SAT Ba accepted / ready for beam
S007	M102	Assembly in tunnel finished
S008		**Bringing into service / commissioning**
S008	A12	Execute SAT Bb - with beam
S008	M12	SAT Bb accepted / ready for operation

Table 1: Activities (A) and milestones (M) of the FAIR project

5.3 Reviews, Inspections and Measurements

5.3.1 General Remarks

5.3.1.1 Factory Acceptance Test (FAT) will take place at the Contractor's site before shipment, to verify the given specifications of the components.

5.3.1.2 All or some of these tests will be repeated after the component has been delivered (SAT A).

5.3.1.3 The final acceptance document will be signed after the component is mounted and has undergone a test operation at its final position in the accelerator complex (SAT Ba).

5.3.1.4 During the acceptance tests, all specified properties of the components have to be proven and demonstrated. This comprises for example the electrical, mechanical and vacuum properties of the device.

5.3.1.5 Acceptance tests are only valid if they are documented in proper form as agreed in the review meetings, and are accepted by the Company.

5.3.1.6 The Contractor shall be responsible for providing all necessary measurement tools/equipment and devices.

5.3.1.7 Testing of prototype or first of series is defined in the Common Specifications and/or the Detailed Specifications.

5.3.1.8 Testing of serially produced components is defined in the Common Specifications and/or the Detailed Specifications.

5.3.2 Quality Assurance at Contractor's Site

5.3.2.1 Standards in the style of ISO9001 have to be respected. That requires that all modules to be produced are supported by an approved and formal process designed to monitor and record each phase of the design, manufacturing and testing.

The Contractor will hand over to the Company an adequate set of process descriptions and documents which show the adherence of the Contractor's QM system to the ISO9001 (or an equivalent or higher standard).

5.3.2.2 A test plan has to be established by the Contractor. Changes to the test plan have to be communicated to the Company and must be agreed by the Company. The test plan describes especially the required FAT tests.

5.3.2.3 The Contractor defines and executes individual sub-assembly inspection and test procedures at each stage. They must be designed to allow basic faults to be rapidly located, identified, and their causes eliminated by the Contractor.

5.3.2.4 The Contractor has to prepare a test protocol of each reached and executed acceptance test.

5.3.3 Tests and Reviews at the Contractor's Site

5.3.3.1 The Contractor shall carry out all specified intermediate acceptance tests and other investigations. The Contractor shall record in protocols the results of the intermediate acceptance tests and other investigations, and shall immediately inform the Company of those.

5.3.3.2 After the completion of a component, a test of all measurable figures and their compliance with the specified tolerances shall be carried out on the Contractor's Site.

5.3.3.3 After receiving notification of readiness for tests, the Company will decide on a case-by-case basis whether the test shall be carried out in the presence of representatives of the Company or whether the issuance of a test certificate is sufficient.

5.3.3.4 If the results of the test show that additional work is necessary, compliance with the specified tolerances shall be proven once again in cooperation with the Company.

5.3.3.5 The acceptance tests at the Contractor's Site (FAT) have to be conducted in attendance of a representative of the Company.

5.3.4 Tests and Reviews at the Company's Site

5.3.4.1 A set of tests and quality assurance activities will be executed by the Contractor on his own cost at the Company's site (SAT A).

5.3.4.2 Samples of the delivered goods will be functionally tested by using test environments of the Contractor (SAT A).

5.3.4.3 Test material and test equipment for the SAT Aa and SAT Ab tests have to be delivered by the Contractor together with the components.

5.3.4.4 A set of Site Acceptance Tests (SAT Aa) will be done after delivery to the Company to ensure the integrity of the component.

5.3.4.5 Tests for SAT Ab acceptance can only begin after successful completion of these Site Acceptance Tests (SAT Aa).

5.3.4.6 Either all tests of the FATs or a random sample of the FATs will be repeated at the Company's site. After the successful test SAT Ab the component shall be approved for installation.

5.3.4.7 Tools/equipment and facilities for the tests shall be kept for three years after the final acceptance of all components free of charge and such that they are protected from corrosion, theft, and distraint. Subsequently, they shall be delivered to the Company or shall continue to be stored for a fee. The Contractor shall invoice the storage expenses to the Company along with the main quotation.

5.3.4.8 The Company shall be informed about the Contractor's planned measures three months before the three-year period expires.

5.3.5 High precision geometric measurement services – Fiducialisation

5.3.5.1 All fiducialisation measurements will be performed at GSI.

5.3.5.2 All survey and alignment activities including fiducialisation measurements will be performed by external measurement specialists, authorised and supervised by GSI.

5.3.5.3 Information about which components have to be surveyed has to be taken from the respective Detailed Specifications.

5.3.5.4 A Contractor, whose components have to be fiducialised, surveyed and aligned at their final place in the tunnel, is responsible for the transport to the measuring site for fiducialisation and afterwards into the tunnel (assembly crew of contractor).

5.3.5.5 The Contractor has to adhere to the time limits scheduled for the dedicated components.

5.3.5.6 The Contractor has to transport the component to its place of final destination and has to pre-align it roughly with respect to existing floor markings (accuracy 1-5mm).

5.3.5.7 The Contractor agrees to support the measurement specialists in the alignment works.

5.3.6 Site Acceptance Tests

5.3.6.1 The final acceptance test shall be carried out after delivery to the designated location. The results of the previous tests can be taken into consideration. A final acceptance test protocol shall be drawn up. After the successful SAT B test the component is handed over for operation.

5.4 Quality Assurance Reporting

5.4.1 At the latest upon delivery, the Contractor shall provide all design documents in “as-built” quality, all material certificates, all test and measurement protocols and all documentation regarding the production/assembly process.

5.4.2 Drawings shall be submitted which document the current status of the component. At the same time all information shall be provided which includes special procedures such as cleaning requirements, special handling requirements or assembly instructions.

5.4.3 The Contractor shall send written quality assurance reports as defined in the Q-Plan. An annex shall include all records related to tests and agreements that have taken place.

5.4.4 The Company shall be informed in writing (e-mail) in due time of any events during construction/assembly which may cause a delay in construction/assembly and delivery.

5.5 Manufacturing Faults

5.5.1 In case of manufacturing faults, modifications, repairs or replacements have to be carried out on all components affected at the Contractor’s expense.

6. Documentation

6.1 The standard language of all documents is English.

6.2 If the Contractor has to write technical specifications, the use of the specification template provided by the Company is obligatory

6.3 During production, the Contractor shall assemble production/assembly documentation with photos of the most important devices and processes. The Contractor shall submit comprehensive operating instructions, risk analyses and trouble-shooting documentation for all components and systems.

The following are examples of documentation:

- User manual
- Maintenance manual
- Test protocols
- Protocol set of the Factory acceptance tests (FAT)
- Protocol set of the Site acceptance tests (SAT)
- Instruction protocols
- Drawings, 3D models
- Proof of compliance with regulations and directives
- Material inspection certificate 3.1 acc. DIN EN 10204:2005-01
- Bill of materials
- Lists of spare parts
- Electronic layouts, schematics
- Strength analysis for welded joints
- Acceptance certificate for welded products
- Acceptance certificates from governmental authorities
- TÜV or LGA expert opinions
- Handling requirements for assembly/mounting and lifting equipment

6.4 The requirements of the standard IEC 82079:2012 (former IEC 62079:2001) shall be complied with in drawing up the technical documentation and its contents. The technical documentation shall be divided into logical sections and shall have a clear structure.

6.5 A change log is generally used so that different versions of a file can be traced. The ISO 6789:2003 is one standard that provides an overview of the compilation of documentation.

6.6 The documentation of the mechanical design must comply with the requirements of the Design Guideline [3] .

6.7 At latest upon delivery the documentation must be completely given to the Company in

- electronic form
  - non-changeable format
  - changeable format
- and one paper copy

6.8 The documentation, especially the sets of drawings to be delivered on digital media, must comply with the requirements of the data exchange standards [10], [11].

7. Shipping / Transportation

7.1 The Contractor shall be responsible for all necessary shipping and/ or transportation of

- Equipment,
- Assembly devices,
- Production or FAT/SAT required items provided by the Company and units to operate the equipment for the measuring tasks according to the Technical Guideline F-TG-T-01e Transport [12].

7.2 The terms of delivery shall be carried out according to the STC of the Company, the Technical Guidelines (e.g. [12], [13], [14]), and the German Packing Ordinance. All delivery shall be covered by DDP, INCOTERMS 2010.

In the case of deviations, they are separately specified in the contract.

7.4 During transport the Contractor carries the responsibility for human safety and for the safety and security of the transported goods.

7.5 The packaging of the shipped components has to be marked on two neighbouring sides with correspondent CIDs.

8. Miscellaneous

8.1 General Remarks

8.1.1 During the execution of the project it might become necessary to adapt the technical parameters. If this does not influence the content of the delivery or service the Company is allowed to do this with just information of the Contractor.

8.1.2 The Contractor agrees to inform the Company in due time about any circumstances, which may be a reason to change parameter of the component or which may change the approved “Detailed Time Schedule” in the contract.

8.1.3 Any changes have to be agreed on by the Company according to the change management procedures.

8.2 Provisions of the Company

8.2.1 The Company will develop in due time the personal safety organization on the construction side including writing and communication of the corresponding safety instructions.

8.2.2 The Company will provide the supply of cooling water, technical gases, pressurized air, electrical power and environmental conditions (light, air, temperature) according to the requirements specified for the operation phase (cf. Detailed Specifications).

Any additional requirements needed by the Contractor for the assembly or construction phase are in principle not available.

The Contractor may in this case contact the Company in order to elaborate separate agreements for local support.

8.2.3 Every FAIR component has to be labelled with a unique number, called component ID (CID) [15]. The CID will be assigned by the Company.

8.2.4 A nomenclature system is established by the Company to uniquely identify all accelerator systems and sub-systems [16]. The Contractor has to follow the naming convention established by the Company

8.3 Requirements on Personnel

8.3.1 All components supplied for a system have to be manufactured by trained and qualified people.

8.3.2 If measurement at the Company's site has been agreed upon, qualified personnel shall be provided and shall receive instruction from the Company.

9. Annexes

I. Legal Safety Regulations

The information guide Manufacturing and operation of equipment designed for research purposes (BGI/GUV-I 5139 E)[5] aims to provide guidance to meet the legal requirements (CE conformity and workspace safety)[6] [7]

- Gesetz über die Bereitstellung von Produkten auf dem Markt (Produktsicherheitsgesetz ProdSG) – German act on product safety based on the Directive 2001/95/EC on general product safety
- 1. Verordnung zum Produktsicherheitsgesetz (1. ProdSV) – German ordinance based on the Directive 2006/95/EC on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits [Low Voltage Directive (LVD)]
- 6. Verordnung zum Produktsicherheitsgesetz (6. ProdSV) – German ordinance based on Directive 2009/105/EC on simple pressure vessel [Simple Pressure Vessels Directive (SPVD)]
- 9. Verordnung zum Produktsicherheitsgesetz (9. ProdSV) – German ordinance based on Directives 89/392/EEC on the approximation of the laws of the Members States relating to machinery and 2006/42/EC on machinery and the amending directive 95/16/EC (recast) [Machinery Directive]
- 11. Verordnung zum Produktsicherheitsgesetz (11. ProdSV) – German ordinance based on Directive 94/9/EC on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres [ATEX Directive]

[5] Information guide is available online: http://publikationen.dguv.de/dguv/pdf/10002/i-5139e.pdf
[6] German laws are available online: http://bundesrecht.juris.de
[7] European Directives are available online: http://eur-lex.europa.eu/RECH_naturel.do

- 14. Verordnung zum Produktsicherheitsgesetz (14. ProdSV) – German ordinance based on Directive 97/23/EC on the approximation of the laws of the Member States concerning pressure equipment [Pressure Equipment Directive (PED)]
- Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln (EMVG) – German act based on Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC [EMC Directive]
- Strahlenschutzverordnung (StrlSchV) – German radiation protection ordinance based on Directives 96/29/EURATOM, 97/43/EURATOM, and 89/618/EURATOM
- Röntgenverordnung (RöV) – German X-ray protection ordinance based on the Directives 96/29/EURATOM and 97/43/EURATOM
- Arbeitsschutzgesetz (ArbSchG) – German act on the introduction of measures to encourage improvements in the safety and health of workers at work based on the Directives 89/391/EEC and 91/383/EEC
- Betriebssicherheitsverordnung (BtrSichV) – German ordinance based on Directives 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work and 2009/104/EC concerning the minimum safety and health requirements for the use of work equipment by workers at work
- Arbeitsstättenverordnung (ArbStättV) – German ordinance based on Directives 89/654/EEC concerning the minimum safety and health requirements for the workplace and 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work

II. Regulations of German Statutory Accident Insurance

In particular but not exclusive following documents have to be considered

- BGV A1 Grundsätze der Prävention (Principles of Prevention)
- BGV A3 Elektrische Anlagen und Betriebsmittel (Electrical systems and equipment)
- BGV D6 Krane (Cranes)
- BGV D8 Winden, Hub- und Zuggeräte (Jacks, Lifting and Pulling Equipment)
- BGI 545 Gabelstapler (Forklifter)

A complete set of regulations and information on safety and health of workers at work can be found in

http://www.arbeitssicherheit.de/de/html/library/overview (in German)

III. Quality Plan

1. The Contractor shall prepare a comprehensive Quality Plan (Q-Plan) based on ISO 9001 for its deliveries and submit it to the Company for approval. The Q-Plan shall cover the contents given hereafter as a guideline:

1.1. Scope and goals of the Quality Plan

a. Reference to input documents
b. Quality objectives (Specification of quality levels of deliverables)

1.2. Responsibilities

a. Definition and distribution of responsibilities
b. Project management structure

1.3. Specification and drawings

a. Review of contractual specifications
b. Requirements for production drawings

1.4. Resource Management

a. Personnel
b. Infrastructure
c. Machines and equipment

1.5. Communication with Company

a. Progress reports
b. Meetings
c. Project reviews

1.6 Production and Realization

a. Purchase and procurement process
b. Control of subcontractors
c. Manufacturing process maps
d. Identification and traceability
e. Tools, techniques, equipment and methods

1.7. Monitoring and Measurements

a. List and description of quality control steps
b. List of characteristics to be measured with tolerance range
c. Validation and verification tests
d. Process and criteria for final acceptance
e. Control of measurement tools

1.8. Preservation of Products

a. Handling and storage specifications
b. Packaging and transport specifications

1.9. Control of Document, Data and Records

a. List of documents and records
b. Approval procedure
c. Schedule of transmission to the Company
d. Ways of preservation of records

1.10. Control of Non-Conformity of Products

a. Immediate actions on defective products or product not suitable for its final functionality
b. Corrective actions to eliminate the cause of the problem
c. Preventive actions

1.11. Professional Quality and Certification of Personnel

1.12. Assistance: Technical Support to the Company

1.13. Quality Audits

2. The Contractor shall ensure the complete and correct execution of all measures specified in the Quality Plan.

3. The Contractor shall inform the Company in due time of the detection of a non-conformance by issuing a non-conformance report sent to the Technical Coordinator of the Company.

IV. Abbreviations

A	Activity
ACA	Accelerator Construction Agreement
ACC	Accelerator
ACC AAB OB	All Accelerator Board – Operating Board
ArbSchG	Arbeitsschutzgesetz, German act on safety and health of workers at work
ArbStättV	Arbeitsstättenverordnung, German ordinance on safety and health of workers at work
ATEX	Atmosphères Explosives (explosive atmospheres)
AutoCAD®	2D/3D CAD software developed by Autodesk
BGI	Berufsgenossenschaftliche Informationen, information on measures for safety and health of workers at work
BGV	Berufsgenossenschaftliche Vorschriften, German regulations on measures for safety and health of workers at work
BtrSichV	Betriebssicherheitsverordnung, German ordinance on safety and health of workers at work
CATIA®	3D CAD software developed by Dassault Systems
CC	Collaboration Contract
CD 0	Critical Decision 0
CDR	Conceptual Design Review
CE	Conformité Européenne (European conformity)
CERN	Conseil Européen pour la Recherche Nucléaire (European Organization for Nuclear Research)
CF-Flange	Conflat Flange
CID	Component-ID
CR	Collector Ring
CS	Common Specification
DARL	Datenaustauschrichtlinie (Data Exchange Guideline)
DDP	Delivered Duty Paid
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DS	Detailed Specification
EC	European Commission
EDMS	CERN Engineering Data Management System
EEC	European Economic Community

EMC	Electromagnetic Compatibility
EMVG	Gesetz über die elektromagnetische Verträglichkeit von Betriebsmitteln, German act on EMC
EN	European standard
EU	European Union
EURATOM	European Atomic Energy Community
FAIR	Facility for Antiproton and Ion Research
FAT	Factory Acceptance Test
FBTR	FAIR Baseline Technical Report
FDR	Final Design Report
GS	General Specification
GSI	GSI Helmholtzzentrum für Schwerionenforschung GmbH (GSI Helmholtz Centre for Heavy Ion Research GmbH)
GUV	Gesetzliche Unfallversicherung, German Statutory Accident Insurance
HEBT	High Energy Beam Transport System
HESR	High Energy Storage Ring
IEC	International Electrotechnical Commission
IKC	In-kind Contribution
INCOTERMS	International Commercial Terms
ISO	International Organisation for Standardization
KRL	Konstruktionsrichtlinie (Design Guideline)
LGA	Landesgewerbeanstalt Bayern, German certification company
LVD	Low Voltage Directive
M	Milestone
p-Bar	Antiproton Target and Separator
PED	Pressure Equipment Directive
PLC	Programmable Logic Controller
PR	Product Readiness
ProdSG	Produktsicherheitsgesetz, German act on product safety
ProdSV	Verodnung zum Produktsicherheitsgesetz, German ordinance on product safety
PSM	Pre Series Module
PSP	Project Structure Plan (code numbers in the cost book)
PSS	Personal Safety System
QA	Quality Assurance
QM	Quality Management
Q-Plan	Quality Plan
RF	Radio Frequency
RöV	Röntgenverordnung, German X-ray protection ordinance
SAT	Site Acceptance Test
SIS 100/300	Schwerionensynchrotron 100/300, heavy ion synchrotron with maximum magnetic rigidity 100/300 Tm
SPVD	Simple Pressure Vessels Directive
STC	Standard terms and conditions of purchase
StrSchV	Strahlenschutzverordnung, German radiation protection ordinance
TDR	Technical Design Report

TG	Technical Guideline
TS	Technical System
TÜV	Technischer Überwachungs-Verein, German technical inspection association
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik (Association for Electrical, Electronic and Information Technologies)
VDI	Verein Deutscher Ingenieure (Association of German Engineers)

V Literature

[1] F-TG-S-5.2e, "Coloring magnets".
[2] F-TG-B-01e, "Material Selection Radiation".
[3] F-TG-B-04e, "Design Guideline (KRL)".
[4] F-TG-ET-01e, "Electrical Design Rules and Regulations".
[5] F-TG-C-01e, "Ethernet Network Connectivity".
[6] F-TG-C-02e, "Equipment Control Interfaces".
[7] F-TG-C-03e, "Equipment Interlock and Status Signal Interface".
[8] F-TG-C-04e, "Equipment Functional Requirements".
[9] F-CS-C-01e, "Common Specification for the FAIR Accelerator Control System".
[10] F-TG-B-02e, "Data Exchange Guideline I (DARL T1)".
[11] F-TG-B-03e, "Data Exchange Guideline II (DARL T2)".
[12] F-TG-T-01e, "Transport - Transport".
[13] F-TG-T-02e, "Transport - Existing Infrastructure".
[14] F-TG-T-03e, "Transport - Installation".
[15] F-TG-B-0.5e, "Component-Identification and Barcode".
[16] V. R. Schaa, F. Peldzinski, M. Kühne and Bayer, Wolfgang, "System for Nomenclatures of Accelerator Devices at FAIR & GSI," [Online]. Available: https://www-acc.gsi.de/wiki/Accnomen.