GARANTIA DE CALIDAD EN EL PROYECTO NUCLEAR EN ATUCHA II REFERIDO A ENSAYOS NO DESTRUCTIVOS

ATUCHA II PROYECT QUALITY ASSURANCE SYSTEM RELATED TO NON DESTRUCTIVE EXAMINATIONS

por / by

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RESUMEN

El sistema de Garantía de Calidad implementado para la construcción de la Central Nuclear en Atucha II debe proporcionar confianza en la operación segura de la misma. Los Ensayos No Destructivos, como parte de dicho sistema, desempeñan un rol decisivo durante las etapas de fabricación y montaje de componentes. Las condiciones y extensión de los exámenes se especifican con detalle. La implementación de estos requisitos por parte del fabricante o montador se controla cuidadosamente y en ciertos casos, se suplementa con exámenes adicionales. Los resultados de estos exámenes se documentan y conservan para referencia durante la vida útil del componente.

SUMMARY

The Quality Assurance System implemented for the proyect Atucha II Nuclear Power Plant must give confidence on satisfactory performance during operation. As a part of the system, Non Destructive Examinations play a key role during manufacturing and erection of components. The requirements to be met and the extent of coverage are specified with detail. The performance of the examination by manufacturer or installer is controlled and for given components, supplemented with additional examinations. Records are produced and keeped during the lifetime of the component.

1. Introducción

El sistema de Garantía de Calidad que cubre las actividades del Proyecto Central Nuclear en Atucha II fué establecido de modo de cumplir los requisitos del "Código de Práctica 50-C-QA: Garantía de Calidad para la seguridad de centrales nucleares" de la Agencia Internacional de Energía Atómica y de la Autoridad de Licenciamiento argentina. Este sistema de Garantía de Calidad cubre las actividades de diseño, compras, fabricación, puesta en marcha y operación de la Central Nuclear.
Por lo tanto, es aplicable a todas las organizaciones y actividades involucradas en el Proyecto. (Ver figura 1)

El sistema está descripto en el Programa Global de Garantía de Calidad.
En él se describen las organizaciones del propietario y de sus contratistas principales, la relación con los subcontratistas y las actividades relacionadas con la calidad a ser desarrolladas durante la realización del Proyecto. Es presentado para su revisión y aprobación a la Autoridad de Licenciamiento.
El Programa Global de Garantía de Calidad está concebido en forma modular.
Cada módulo cubre un tipo particular de componente o actividad.(Ver fig.2)

En esta presentación nos referiremos principalmente a la fase de fabricación de componentes mecánicos relacionados con la seguridad, y específicamente a la aplicación de los END como herramienta necesaria para lograr la finalidad propuesta, de acuerdo a lo definido en la sección 3 del Programa

1. Introduction

The Quality Assurance System that covers the activities of Atucha II Nuclear Power Plant project was established in order to fulfill the requirements of the International Atomic Energy Agency "Code of Practice 50-C-QA Quality Assurance for safety in nuclear power plants" and of the Argentine Licensing Authority.
This Quality Assurance system covers the activities of design, procurement, manufacturing, commissioning and operation of the Nuclear Power Plant.
Therefore, it is applicable to all organizations and activities involved in the Project. (See Fig. 1)

The system is described in an Overall Quality Assurance Program.
It describes the organizations of the owner and their main contractors, the relation with their sub-contractors and the quality functions to be performed during the development of the project. It is presented for review and aproval to the Licensing Authority.
The Quality Assurance Program is designed in a modular presentation.
Each modulus covers a different type of component or activity (See Fig. 2)

During this presentation we will mainly deal with manufacturing of safety related mechanical components, and specifically, to the application of NDE as a necessary tool to reach the proposed objective, as defined in Section 3 of the Overall Quality Assurance Program.

2. Clasificación de componentes

Como los distintos componentes de una Central Nuclear tienen influencias distintas en la seguridad de la misma, es necesario establecer un sistema de clasificación que permita graduar la intensidad del control sobre los mismos (Ver figura 3)

Estructuras, sistemas y componentes asociados con la seguridad del público y operadores y esenciales para la operación, están definidos como Items Relacionados con la Seguridad. Estructuras, sistemas y componentes que no están asociados a la seguridad del público y cuya falla podría producir una reducción en la performance de la central, se definen como items No Relacionados con la Seguridad.
Clase de Calidad es un sistema de clasificación de ítems de acuerdo al cual las estructuras, sistemas y componentes importantes para la seguridad y disponibilidad son diseñados, fabricados , ensayados e inspeccionados de acuerdo a requisitos y normas compatibles con la importancia de la función que desarrollen. Los principales factores que determinan la Clase de Calidad de un componente son:

- Influencia sobre la seguridad de una deficiencia del componente.
- Influencia del componente en la disponibilidad de la Central
- Complejidad del diseño
- Experiencia previa con componentes similares.

2. Component Classification

Since the different components of a Nuclear Power Plant have different influences on the safety of the plant, it is necessary to establish a classification system which allows for grading the quality assurance effort. (See fig. 3)

Structures, systems and components associated with health and safety of public and operators and essential to operation are defined as Safety-Related Items. Structures, systems and components which are not associated with health and safety of public and whose failure could lead to an outage of the plant or to a major reduction in operation are defined as Non-Safety-Related Items.
Quality Class is a product-oriented classification for items which requires that structures, systems and components important to safety and availability be designed, manufactured, tested and inspected to quality requirements and standards commensurate with the importance of the functions to be performed. Main factors which influence the Quality Class of a component are:

- Effects on safety of a malfunction of the item
- Influence of the component on the availability of the Plant
- Complexity of the design
- Previous experience with similar components.

La Clase de Calidad se indica en la especificación técnica del componente
La clasificación de estructuras, sistemas y componentes en Clases de Calidad está de acuerdo con la Guía de Seguridad 50-SG-D1 "Funciones de seguridad y clasificación de componentes para BWR, PWR y PTR"
Para aclarar el sentido del concepto Clase de Calidad, en la Fig. 4 se muestra un ejemplo.

3. Fase de pre-adjudicación

Previo a la adjudicación de un contrato, ENACE realiza una evaluación de los eventuales proveedores. El objetivo de esta evaluación es determinar si la capacidad y experiencia de los proveedores son apropiados para la fabricación y ensayo del componente considerado. Los equipos para END y la calificación de los operadores son exhaustivamente analizados. Si alguna deficiencia es identificada, los requisitos necesarios para su solución son incorporados al contrato (Ver figura 5)

A fin de facilitar la preparación de las ofertas, se brinda la asistencia necesaria para la correcta interpretación de especificaciones y normas.

4. Fase contractual

Los requisitos de Garantía de Calidad aplicables a la etapa de fabricación son transferidos al proveedor del componente. Como resultado, éste debe implementar su propio sistema de QA para asegurar el cumplimiento satisfactorio de estas exigencias.

The classification of structures, systems and components into Quality Classes is in compliance with IAEA Safety Guide 50-SG-D1 "Safety functions and component classification for BWR, PWR and PTR".
The Quality Class is stated in the Component Specification.
An example to clarify the meaning of Quality Class concept can be seen in Fig. 4.

3. Pre-contract award phase

Previously to award a contract, an evaluation is performed by ENACE to the potential suppliers.
The purpose of the evaluation is to determine whether the capability and experience of the suppliers are adequate for manufacture and testing of the component. NDE equipment and operators qualifications are carefully considered in this evaluation. In case any deficiency is found, necessary requirements to be fulfilled are stated in the contract. (See fig.5)

To help prepare the offer, necessary asistance for interpretation of specifications and standards is given to the potential supplier.

4. Contractual phase

The QA requirements applicable to the manufacturing step are transferred to the supplier. As a result, the supplier have to implement its own QA system, to assure the satisfactory fulfillment of quality requirements.

Los requisitos de QA son establecidos contractualmente y comprenden dos tipos de exigencias:

a) Exigencias relativas al sistema de Garantía de Calidad del proveedor, esto es, características de la organización de la empresa a fin de brindar una cierta confianza que los requisitos de calidad son cumplidos. Estas exigencias están contenidas en el concepto de Categoría de Garantía de Calidad (Ver figura 6).
La aplicación de estas exigencias depende de la Clase de Calidad del componente. La relación se muestra en la Figura 7.

b) Exigencias relativas al producto, esto es, aplicable a un componente en particular. Estos requisitos están contenidos en las especificaciones (Especificaciones de componentes, de procesos y de materiales). Basado en estos requisitos, el fabricante prepara los documentos de fabricación necesarios (procedimientos de soldadura, de tratamientos térmicos, instrucciones de ensayo, etc.). Antes del comienzo de fabricación, estos documentos se presentan a ENACE para la revisión. (Ver figura 8)

5. Requisitos de END

La extensión de END a ser realizados por el fabricante y por ENACE se indica en la orden de compra y las respectivas especificaciones.

The QA requirements are fixed in the purchase order, and can be divided into two types:

a) Requirements related to the supplier's QA system, that is, organizational conditions of the company to give adequate confidence that the quality requirements are met. These requirements are summarized in the concept of Quality Assurance Category.
(See fig.6)

The extent to which these requirements apply depends on the Quality Class of the component. The relation is shown in Fig. 7.

b) Requirements related to the product that is, applicable to a given component. These requirements are stated in the Specifications (Component, Process and Material Specifications). Based on all these requirements, the Manufacturer prepares all necessary manufacturing documents (welding procedures, heat treatment plans, examination instructions, etc.). Before beginning of manufacture, these documents are presented for review and release by ENACE. (See fig.8)

5. Non Destructive Examination Requirements

The extent of NDE to be performed by supplier and ENACE is stated in the purchase order and applicable specifications.

Los requisitos de END para la Central Nuclear en Atucha II son los normalmente usados en Alemania para la construcción de centrales nucleares.
En estas especificaciones, se da preferencia al exámen volumétrico con ultrasonidos frente al exámen radiográfico, tanto para exámenes durante la fabricación como durante el servicio. Se especifica un barrido detallado a fin de cubrir las posibles orientaciones de defectos. Un ejemplo puede verse en la Figura 9 que muestra las direcciones de barrido requeridas para el exámen de una soldadura.

5.1. Calificación del personal de END

Para asegurar una correcta realización y evaluación de los END, se requiere que todo el personal a cargo de los mismos este adecuadamente calificado, tanto a nivel de operador como de supervisor.
Pueden aplicarse los procedimientos siguientes:

a) Procedimiento de CNEA, Resolución N° 371/78.
b) Práctica alemana, de acuerdo al DGZfP (Deutsche Gesellschaft für Zerstörungsfreie Prüfverfahren e.V.)
c) Práctica recomendada SNT-TC-1A de American Society for Non-Destructive Testing.

Aún cuando se admite la provisión de servicios por terceros, la supervisión debe ser realizada por el fabricante.

The NDE requirements for Atucha II NPP are those normally used in Germany for nuclear power plants construction. In these specifications preference is given to volumetric examination by ultrasonic instead of radiographic for in process examination as well as in service examination.
Extensive scaning is required to cover most defects orientation. An example can be seen in Fig. 9, showing the required scanning directions for the examination of a weld.

5.1. Personnel qualification of NDE personnel

To assure a correct performance and evaluation of NDE, it is required that all NDE personnel be qualified, being an operator as well as a supervisor.
The accepted qualification procedures are the following:

a) CNEA procedure, Resolucion N° 371/78.
b) German practice, according to DGZfP (Deutsche Gesellschaft für Zerstörungsfreie Prüfverfahren e.V.)
c) Recommended practice SNT-TC-1A of ASNT (American Society for Non-Destructive Testing).

The performance of NDE services by subcontractors is accepted, but supervision should be done by the supplier.

5.2. Instrucciones de ensayo

El fabricante debe preparar instrucciones detalladas de ensayo. Estas instrucciones o procedimientos definen el método de exámen de cada área, de acuerdo a las especificaciones. Las instrucciones de ensayo contienen los siguientes datos, según corresponda:

- Tipo de equipo
- Método de calibración
- Oportunidad del exámen (p.ej. antes o después del tratamiento térmico.)
- Gráficos y esquemas necesarios para aclarar las instrucciones
- Standard de aceptación y rechazo.
- Datos adicionales que resulten necesarios.

Las instrucciones de ensayo son revisadas y aprobadas por ENACE antes del comienzo de los exámenes.

6. Documentación e informes

Los requisitos crecientes sobre documentación a generar durante fabricación, ensayo y montaje de componentes, ha hecho conveniente establecer un sistema uniforme de documentación para todos los proveedores. Una especificación ha sido específicamente desarrollada para cubrir este tema.
La generación, identificación, revisión, archivo y manejo de documentos, así como su correlación con el componente, están descriptos en detalle.

5.2. Examination instructions

The manufacturer shall prepare detailed examination instructions. These examinations instructions shall define the extent and method of examination for each individual examination area, in accordance with the specifications. The examination instructions shall contain the following data, as applicable:

- Type of examination equipment
- Calibration method
- Time of examination (i.e. before or after heat treatment)
- Necessary sketches to clarify the instructions.
- Acceptance standard
- Necessary additional data

The examination instructions are reviewed and released by ENACE before examination begins.

6. Documentation and reporting

The growing requirements on documentation to be generated during manufacturing, testing and erection of components, made it convenient to establish a uniform system of documentation for all suppliers of components. A Process Specification was specifically developed to cover this subject. Generation, identification, review, filing and handling of documents, as well as its traceability to the component is described in detail.

Se imparten instrucciones adicionales para reparaciones, disconformidades y repuestos. El volúmen y tipo de documento depende de la Clase de Calidad y tipo de componente (recipiente, válvula, cañería, etc.). Los diferentes tipos de documentos y sus interrelaciones se muestran en la Fig. 10.
Se proveen formularios standard. En ellos se ha considerado la posibilidad de transferir los datos a la memoria de una computadora para facilitar la búsqueda de información y reducir el volúmen de almacenaje de documentos (Ver figura 11)

Special provisions for spare parts, repairs and non-conforming items are dealt with. The volume and type of documents depends on the Quality Class and type of component (vessel, pump, valve, piping, etc.).
The different types of documents and its interrelation are shown in Fig.10
Standard forms are provided. Provision is made for later transfer of data into computer memory for easy retrieval of information and reduction of storage volumen. (See fig. 11)

El fabricante debe preparar y firmar los informes de todos los exámenes por los cuales es responsable. Las actividades que debe realizar se muestran en la figura 12.
ENACE realiza, presencia o verifica los exámenes no destructivos, firmando los informes respectivos, de acuerdo a lo que se indica en la fig. 13. Obviamente, la intensidad del control por parte de ENACE es función de la Clase de Calidad del componente.

The manufacturer shall prepare and sign the records for all examinations for which he is responsible.
(See fig. 12)

ENACE performs, witness or verifies, countersigning the respective records, according to what is shown in Fig.13. It can be seen that the Quality control effort of ENACE depends on the Quality Class of the components.

7. Archivo

Los certificados e informes se clasifican en Permanentes y No permanentes. Se imparten instrucciones específicas para identificar los documentos que deben ser conservados durante toda la vida útil del componente. Los informes de END son una porción importante de estos documentos.

7. Filing

Certificates and records are classified into Permanent and Non Permanent records. Specific instructions are issued to identify the records to be retained for the life of the component. NDE records are a sizeable portion of these records.

En la figura 14 se resumen los documentos más relevantes, indicando también su clasificación.
El sistema de archivo permite una búsqueda rápida de documentos.
Todos los documentos permanentes se agrupan en el asi llamado "Paquete final de datos". Es preparado por el fabricante y verificado por ENACE.
En la Figura 15 se indica como está organizado.

Fig. 14 shows the relevant documents, along with its clasification.
The filing system allows for easy retrieval and traceability of documents. The Final Data Package contains all permanent documents.
It is prepared by the manufacturer and verified by ENACE. Its organization is shown in Fig. 15.

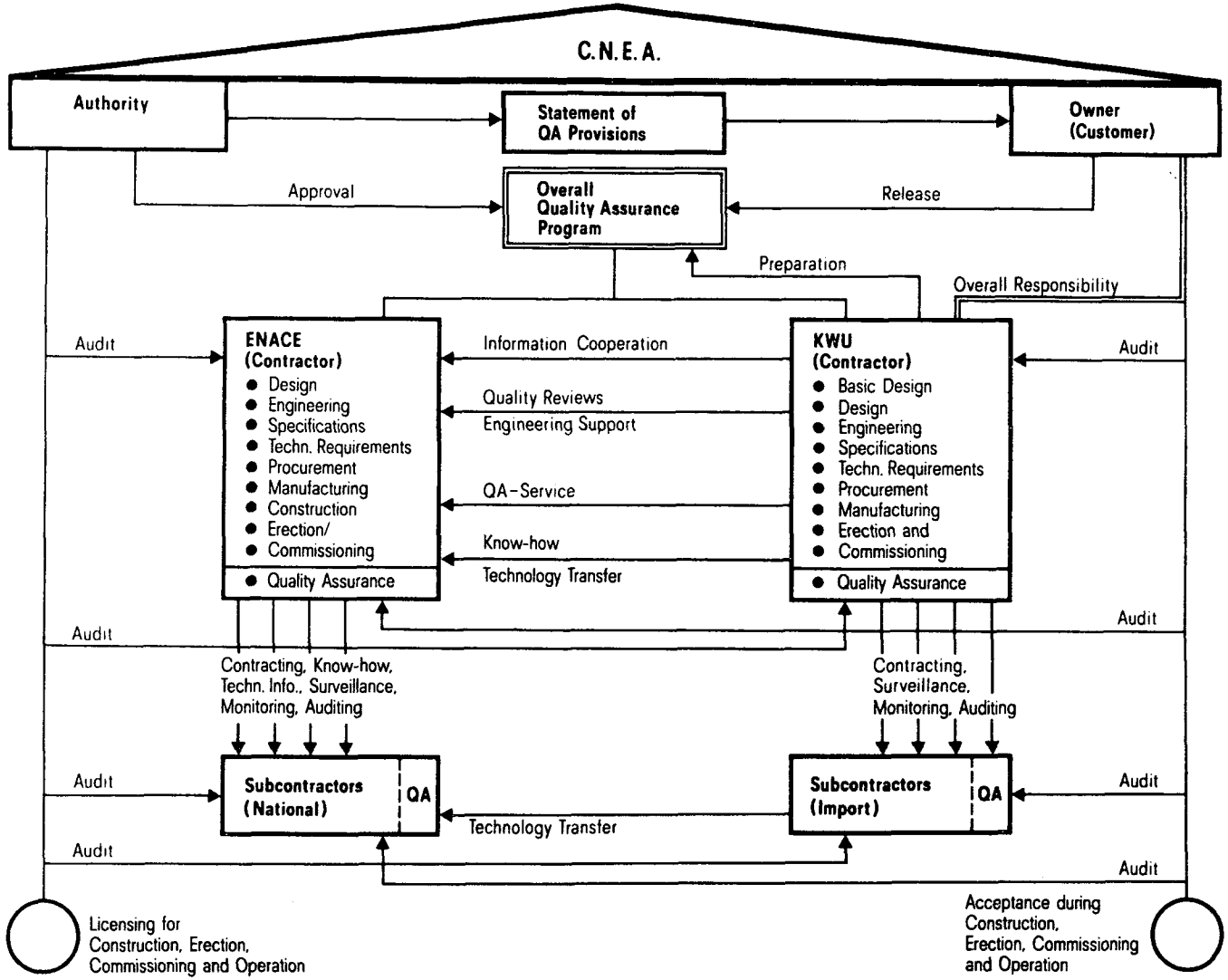


FIGURE 1: Interaction of Quality Assurance Activities of Main Parties

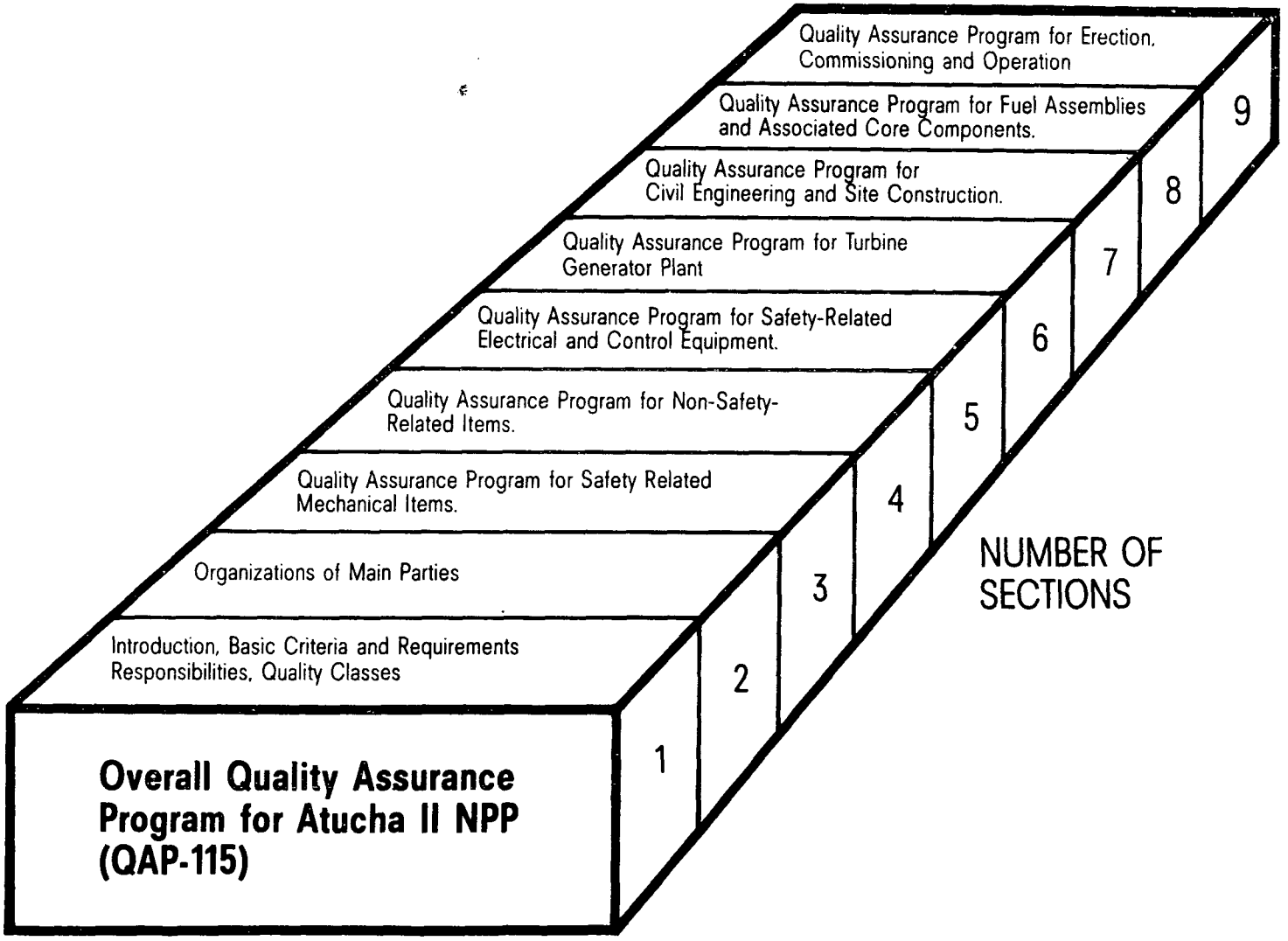


FIGURE 2: Modular Presentation of Overall Quality Assurance Program

	Quality Classes For Mechanical Items	Safety Classes according to IAEA Safety Guide No. 50-SG-D1	Safety Functions	Quality Assurance Requirements	
Safety Related	1 2 3	1 2, 3 3, 4	k, d f, l, e_2, i, o a, n, h, i, o, q, p, s	QSP E 4a/15B	Quality Assurance Program/System according to IAEA Safety Series No. 50-C-QA or equivalent standards (e.g. ANSI/ASME NQA-1, CSA Z 299.1 to 3) and to applicable Specifications.
Non Safety Related	4a (predominantly according to UVV) 4b (with speoial requirements to the manufacture)				Quality Assurance/Control or Inspection Plan according to Technical Requirements/ Specifications, Procurement Documents as specified in the national standard and rules.
					Conventional industrial codes and standards, Suppliers' or Subcontractors' Technical Documents.

FIGURE 3: Interaction between Quality Classes and Safety Classes/Safety Functions for Mechanical Items

		Quality Class 2	Quality Class 3
Maximum weld edge misalignment	longitud. weld	0.1 s (max. 2 mm)	0.15 s (max. 3 mm)
	circunf. weld	0.15 s (max. 3 mm)	0.15 s (max. 3 mm)
Examination of ferritic welds >15 mm		100 % UT + 10 % RT	100 % UT

FIGURE 4

Evaluation Requirements

- **QA-System**

  According to:
  - ASME Section III, NCA 4000
  - CSA Z 299
  - Atucha II Project Regts: QSP 4a/15B

- **Personnel**

  NDE Personnel: (see Paragraph 5.1)

  Welding Personnel:
  - DIN 8560 + AD HP3
  - ASME Section IX

- **Equipment**

  According to manufacturing techniques to be used, and examination and testing requirements

- **Procedures**
  (Welding, Forming, Heat treatment, etc.)

  According to Technical Specification Requirements

FIGURE 5

Appendix A Section		QAC 1	QAC 2	QAC 3	addit. requirements 1)
II.	BASIC REQUIREMENTS				
1.	ORGANIZATION				
	1.1 Organization Chart	x	x	x	
	1.2 Flow of Information	x	x		x
	1.3 Independence	x	x		
	1.4 Personnel training	x	x	x	x
2.	QUALITY ASSURANCE PROGRAM				
	2.1 Scope of the Quality Assurance Program	x			
	2.2 Definition of the Quality Assurance Program/ System	x	x	2)	x
	2.3 Application of the Quality Assurance Program	x			
3.	DESIGN				x
	3.1 Preparation of Design Documents	x			
	3.2 Review of Design Documents	x			
	3.3 Changes	x			
4.	PROCUREMENT				
	4.1 Selection of Suppliers	x	x		
	4.2 Supplier's QA/QC Program	x	x		x
	4.3 Procurement Documents	x	x		
5.	MANUFACTURING, ERECTION AND COMMISSIONING DOCUMENTS	x	x		x
6.	DOCUMENT CONTROL				x
	6.1 Preparation and Review of Documents	x	x		
	6.2 Distribution of Documents	x	x		
	6.3 Changes to Documents	x	x		
7.	INCOMING INSPECTION	x	x		
8.	IDENTIFICATION OF ITEMS				x
	8.1 System of Identification	x	x	x	
	8.2 Transfer of Identification	x	x		
9.	SPECIAL PROCESSES	x	x		x
10.	IN PROCESS INSPECTION	x	x		x
11.	TESTING	x	x	x	x
12.	MEASURING AND TESTING EQUIPMENT	x	x	x	
13.	HANDLING, STORAGE, SHIPPING AND PRESERVATION	x	x		x
14.	INSPECTION STATUS	x	x		x
15.	NONCONFORMANCE	x	x	x	x
16.	CORRECTIVE ACTION	x	x		
17.	QUALITY ASSURANCE RECORDS				
	17.1 General QA Records	x			
	17.2 Product related Quality Records	x	x	x	x
18.	AUDIT	18a	18b	18c	

1) Specific product related QA requirements of the specification must be considered.
2) Inspection Test and Surveillance Activities are generally controlled by an Inspection Plan/Test Plan as required by the specification

FIGURE 6: Quality Assurance Requirements to be applied for Quality Assurance Categories 1, 2 and 3

QAC Quality Assurance Category	Materials, Parts or Semi-Finished Products and Castings	Components and Subassemblies
1	—	Quality Class 1 and 2[1)]
2	Quality Class 1 and 2	Quality Class 2[2)] and 3
3	Quality Class 3	—

Footnote

1) Quality Class 2 components under the following circumstances

   -- the contract includes complex design and analytical or testing activities and/or

   -- the technical requirements are mainly specified by functional criteria and quality characteristics rather than by testing and quality control requirements

2) Quality Class 2 components under the following circumstances

   -- the product is of proven design and/or

   -- the compliance of the product's quality with the technical requirements can be demonstrated by inspections and tests of material, parts, components, equipment and other activities and of the final product.

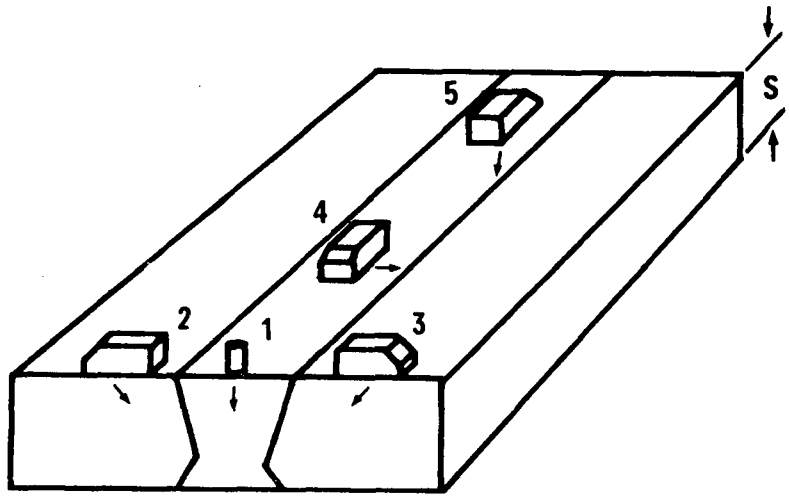
FIGURE 7: Application of Quality Assurance Categories for Mechanical Items

Documents for Review and Release for National Scope of Supply

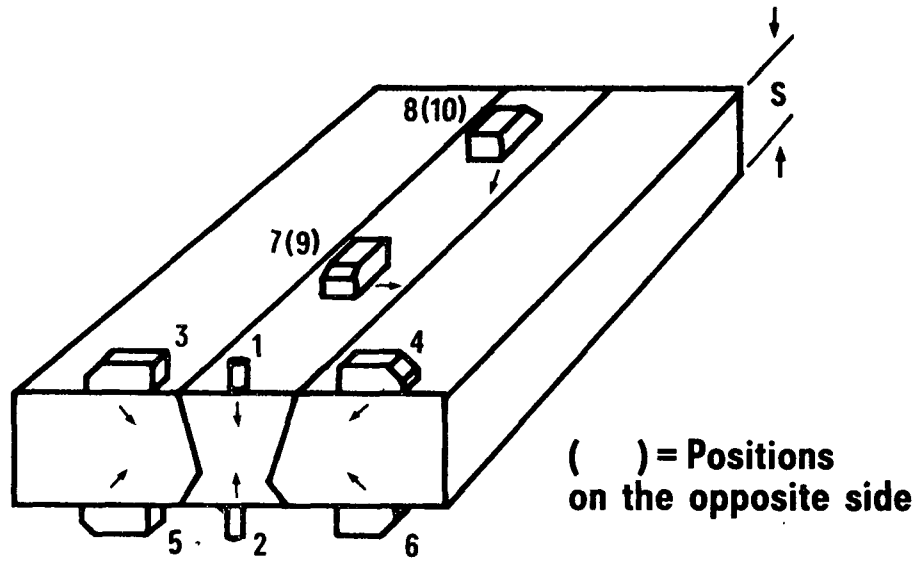
- Manufacturer: – Preparation
  – Review
- Enace: – Review
  – Release

This procedure is applicable for first issue and revisions

FIGURE 8



Sketch 1 Search unit positions for $15 < s \leq 40$ mm
Number of scanning directions: 5



Sketch 2 Search unit positions for $s > 40$ mm
For positions 3-10, with two different scanning angles, the number of scanning directions is 18

FIGURE 9

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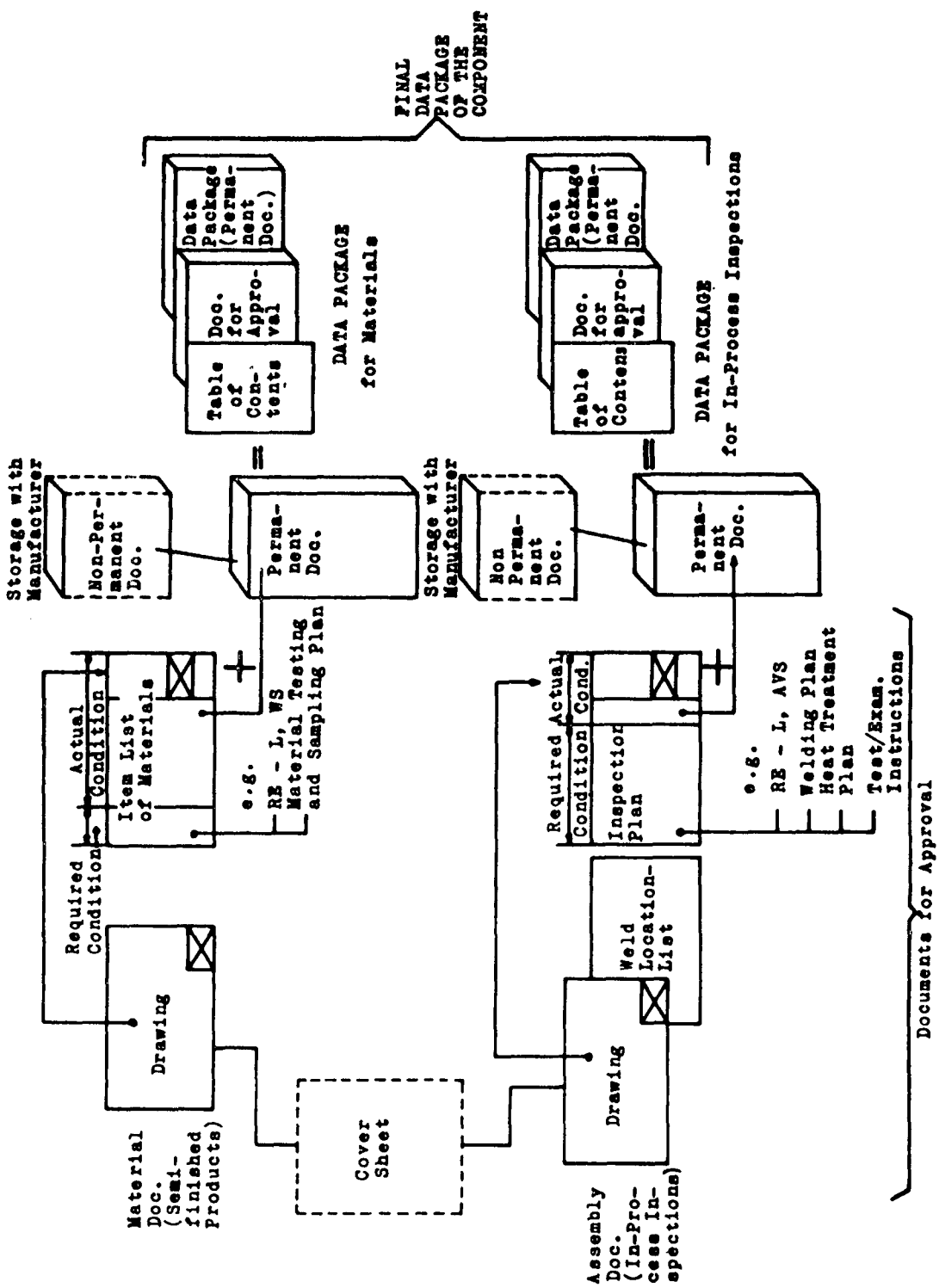

FIGURE 10

ENACE

	Ultrasonic Examination Record	UT ____ Page: ____ of: ____
1 Plant/Project:	Component:	Subassembly:
KKS 1):	IP/MTS/MTP/Quality Class 2):	Exam. No.:
Manufacturer Order No.: Fabricante Orden. No.:	KWU/ENACE Order No.: KWU/ENACE Orden No.:	Type3)/Serial3)/Identification No.4):
Component Specification:	Process Spec.:	Exam.Instruction:
Drawing No.:	Material:	Quantity:

2 Surface Condition-Scanning Surface: -Opposite Surface:

Type of Equipment/Manufacturer: Couplant Agent:

Scanning Position	Type of Search Unit/ Designation	Calibration of Equipment: Distance (mm): Zone	Beam Path	Projection Distance	Short-Projection Distance	Valuation Methode	Calibration Block	Calibration Reflector	Beam Path (mm)	Additions (dB): Correction Value	Number of Measuring Points	Transfer. Correction	Attenuation	Total of Additions	Recording Level	Basis Calibration: s (mm)	ΔV (dB)

3 Annexes 2): Form No. App. 2/13 b ☐ Acceptable/No. indications

Form No. App. 2/13 c ☐ Acceptable/with indications

☐ Not Acceptable ☐ NC No. ____

M ≙ Manufacturer Q ≙ KWU/ENACE	Signature M Place: Date:	Signature Q Place: Date:

1) KKS ≙ Classification System for Power Plants 2) Delete if not applicable 3) Only for pipings and valves

4) e.g.Heat No. or Coupon No. not applicable in relation to IP/MTP

FIGURE 11a

ENACE

	Ultrasonic Examination Record	UT ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊ Page: ⌊⌊⌊ of: ⌊⌊⌊
1 Plant/Project: ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊	Component: ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊	Subassembly: ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊
KKS 1): ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊	IP/MTS/MTP/Quality Class 2): ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊/⌊⌊	Exam. No.: ⌊⌊⌊⌊⌊⌊⌊⌊⌊⌊

2 Weld Location No./ Part No.	Indication No.	Search Unit: Scanning Position	Search Unit: Angle of Scanning (degrees)	Location of Indication: Beam Path (mm)	Location of Indication: Distance from Reference Point X(mm)	Location of Indication: Distance from Reference Point Y(mm)	Depth from: Inside (mm)	Depth from: Outside (mm)	Distance: Weld Center (mm) (mm)	Type of Indica.: Longitudinal	Type of Indica.: Transverse	Type of Indica.: Plan Surface	Result: Exceeding of Recording Length/ Level (dB)	Result: Recording Length/Area 2) (mm) (mm²)	Evaluation: Acceptable	Evaluation: Not Acceptable	Remarks:

M ≙ Manufacturer Q ≙ KWU/ENACE	Signature M Place: Date:	Signature Q Place: Date:

1) KKS ≙ Classification System for Power Plants 2) Delete if not applicable

FIGURE 11b

ENACE

	Surface Crack Examination Record	MT / PT 2) Page: ____ of: ____
1 Plant/Project:	Component:	Subassembly:
KKS 1):	IP/MTS/MTP/Quality Class 2):	Exam. No.:
Manufacturer Order No.:	KWU/ENACE Order No.:	Type3)/Serial3)/Identification No.4):
Component Specification:	Process Spec.:	Exam.Instruction:
Drawing No.:	Material:	Quantity:

2 Surface Conditions:

3 Methode of Magnetization (DIN 54130):	Type of Equipment/Manufacturer:
Type Particels/Manufacturer:	Suspension and Additions:
Contrast Agent:	Type of Black Light Lamp/Manufacturer:

Distance between Prods:	Number of Turns:	Current/Voltage:
Field Strength:	Measuring Tool/Manufacturer/Demagnetization:	

4 Examination System (DIN 54152):	Penetrant/Manufacturer:
Penetrant Remover/Manufacturer:	Developer/Manufacturer:

Pre-Cleaning:	Drying:	Application-Penetrant:
Intermediate Cleaning:	Drying:	Application-Developer:

Evaluation Time:	0h	0,5h	1h	2h		
Number of Idications:						

5 Evaluation:
- ☐ Acceptable/no indications
- ☐ Acceptable/with indications
- ☐ Not Acceptable/ no acceptable

☐ NC No. ____

6 Remarks:

M ≙ Manufacturer Q ≙ KWU/ENACE	Signature M Place: Date:	Signature Q Place: Date:

1) KKS ≙ Classification System for Power Plants 2) Delete if not applicable 3) Only for pipings and valves

4) e.g.Heat No. or Coupon No. not applicable in relation to IP/MTP

FIGURE 11c

Quality Class	1, 2, 3, 4a, 4b
Destructive Tests	P, C, V
Nondestructive Examinations and Inspections	P, C, V
Quality Release	C, V

P: Performance
C: Certification
V: Verification

FIGURE 12

Quality Class		1	2	3	4a, 4b
Destructive Tests		W, V	W, V	W, V	W
Nondestructive Examinations and Inspections	UT	P, V	W	W	W
	RT	W, V	V	V	W
	MT/PT	W	W	W	
	DT	W	W	W	W
	Pressure Test	W, V	W, V	W, V	W
Quality Release		V	V	V	V

P: Performance
W: Wittnes
V: Verification

FIGURE 13

ENACE

Certification of Surveillance Activities Categories, Symbols

ST	≙	Stamping
X	≙	Non-Permanent
PX	≙	Permanent
PXO	≙	Summary, Permanent Certification

Surveillance Activities	Symbols
1. General Qualification Requirements	
Evaluation acoording to HPO or WO	PXO
Evaluation acoording to AD-HP 3,4	PXO
Evaluation acoording to AD-HP 7	PXO
Evaluation according to DIN 8563	PXO
Check of welding procedure qualification	PXO
Check of welder qualification	PXO
Check of equipment for heat treatment	PXO
Check of equipment for preheating	PXO
Check of welding equipment	PXO
2. Inspections, Tests and Examinations	
2.1 Receiving Inspection (Form No.App. 2/2)	PXO
- Check of stamping and marking in acc. with the documentation	ST
- Material certification check	ST
- Check of main dimensions on the basis of as-built drawing	ST
- Material identification check of alloyed steels, spectral analysis	X
- Check for damage	X
2.2 General Inspection Steps	
- Certification of stamping transfer for pressure-retaining parts	PX
- Interstage and final heat treatment (Form No. App. 2/11)	PX
- Leak tests (Nekal, helium) (Form App. 2/16)	PX
- Release for hydrostatic test	X
- Strain measurement	PX
- Hydrostatic test (Form No. App. 2/17)	PX
2.3 Monitoring of Welding	
Monitoring of welding operations (Form No. App. 2/10 and form No App 2/19a,b)	PXO
Check of:	
- filler metals	
- preheat and interpass temperatures	
- welding parameters	
- ground root area	
- cladding thickness during welding	
- temper bead	
- soaking	
2.4 Non-Destructive Examinations	
2.4.1 UT examinations (Form Nos. App. 2/13a,b,c)	
- base material before final heat treatment	X
- base material in final heat treated condition	PX
- weld edge areas prior to weld edge preparation	X

Surveillance Activities	Symbols
- weld joints and cladding before final heat treatment	X
- weld joints and claddings after final heat treatment as far as the examination after the hydrostatic test is not limited	X
- weld joints and cladding after hydrostatic test	PX
- sound attenuation measurement	PX
- volumetric tandem technique	PX
2.4.2 MT/PT examinations (Form No. App. 2/14)	
- base material before final heat treatment	X
- base material in final heat treated condition	PX
- weld edges	X
- surface before cladding	X
- welds and cladding before final heat treatment	ST
- welds and cladding after final heat treatment, if repetition after hydrostatic test is possible	X
- welds and cladding after hydrostatic test	PX
2.4.3 RT examinations (Form No. App. 2/15 a,b,c,)	
- base material	PX
- welds	PX
2.4.4 Dimensional tests	
- main dimensions of base material after machining	PX
- weld edge preparation and misalignment of weld edges	X
- cladding thickness in final condition	PX
- ground radii according to drawing	X
- preliminary dimensions	X
- wall thickness after cutting off temporary attachments	X
- main dimensions and companion dimensions	PX
2.4.5 Visual inspection (Form No. App. 2/25)	
- surface before cladding, painting, etc.	ST
- check for spatter and arc strikes	ST
- check of sandblasting	ST
- check of painting	ST
- check of cleanness	ST
- parts which cannot be inspected after assembly	ST
- protection against rust and damage	ST
- check of packaging	ST
- check of markings	ST
- check of preparations for shipment	X
- check for damage in transit	X
2.5 Destructive Tests	
The results of all destructive tests, required by a Specification, are part of the permanent certification. (Form No. App. 2/30a,b,c,d,e,f)	PX
2.6 Documentation Review/Verification	
Review of Final Data Package and Quality Release (Form No. App. 2/8)	PX

FIGURE 14

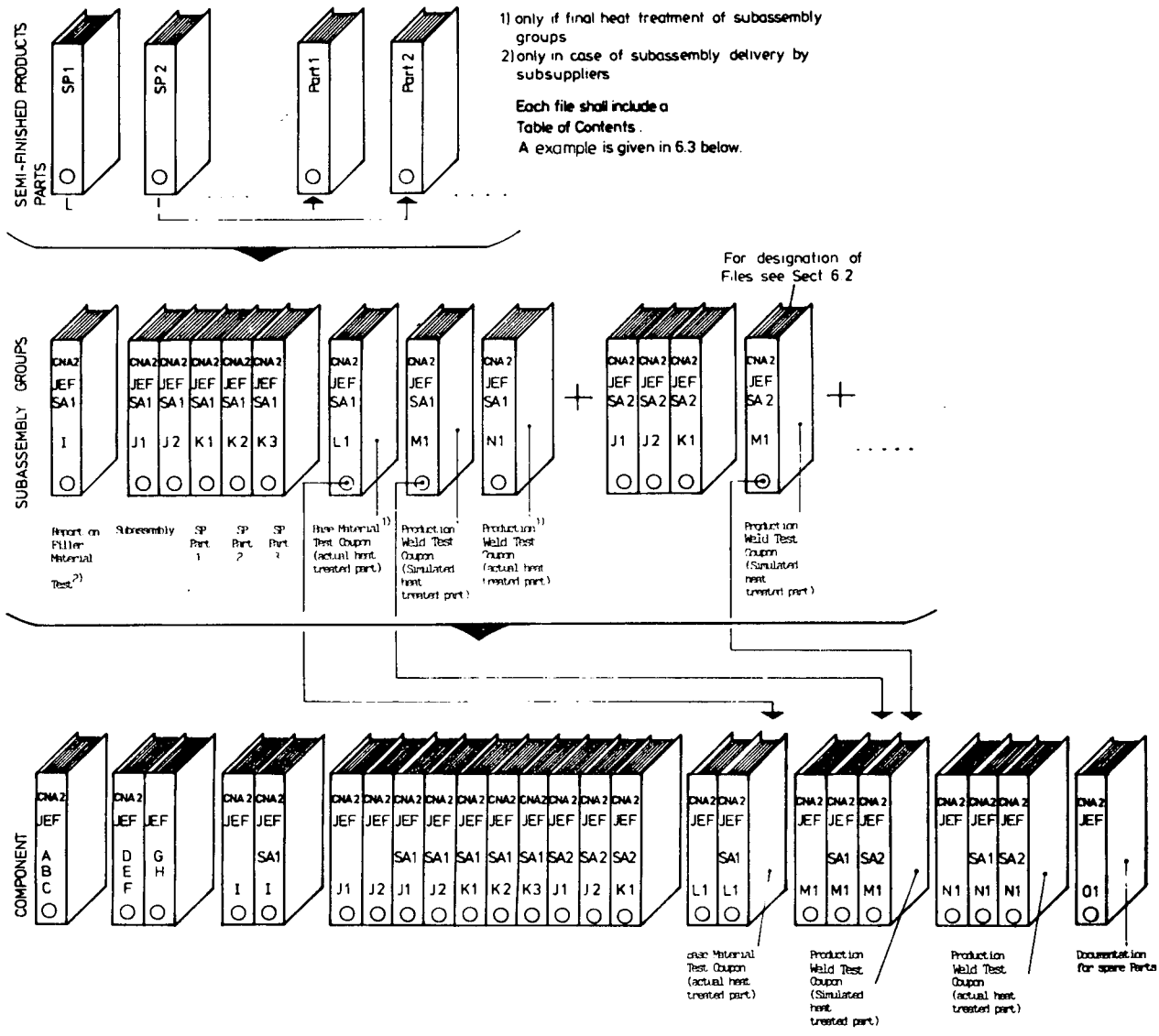
SEMI-FINISHED PRODUCTS PARTS
SP 1
SP 2
Part 1
Part 2
1) only if final heat treatment of subassembly groups
2) only in case of subassembly delivery by subsuppliers
Each file shall include a Table of Contents.
A example is given in 6.3 below.
For designation of Files see Sect 6.2
SUBASSEMBLY GROUPS
COMPONENT
Documentation for spare Parts

FIGURE 15