ANNEX E of SOLAR KEYMARK SPECIFIC SCHEME RULES
FACTORY PRODUCTION CONTROL
BASED ON ISO 9001 STANDARD COVERING THE PRODUCTION LINE

1. General

This annex specifies the requirements for the Factory Production Control (hereafter FPC) and the quality management system covering the production line of solar themal collectors , systems and their components.The requirements mentioned in the following chapter are binding to all manufacturers.

Inspectors will verify compliance with these requirements during their visits with the exclusions indicated in Table1 when the following conditions are met:

- The manufacturer holds an ISO 9001 Certificate that covers in its scope the production and/or the distribution of the certified products, the subclauses marked in the following table may be considered as being complied with.
- , The Certificate must be granted by a Certificaition body that is accredited by an accreditation body that is signatory of the European co-operation for Accreditation (EA), or International Accreditation Forum (IAF).
- The inspections shall randomly check whether all requirements of ISO 9001 are applied for the FPC of the certified products
- The last ISO 9001 audit report must be available for the inspector.

Table 1 – Subclauses of Annex E that may be accepted under ISO 9001 Certification

Subclause		Subclaues of Annex E that may be accepted under ISO 9001 certification
2.1	General	x
2.2	Responsibility and authority	x
2.3	Management representative for the FPC	x
2.4	Quality Objectives	x
2.5	Management review	x
2.6	Training of personnel	x
3.	Quality Documentation	x
4.	Inspection and testing	
4.1	General	
4.2	Test equipment	
4.3	Inspection and testing of raw materials and other constituent materials	
4.4	Inspection and testing during manufacture and on finished product	
4.5	Inspection and test records	
5.	Actions in the case of non-conforming products	
6.	Handling, storage, packaging and marking of products	
7.	Traceability of products	
8.	Internal audit	x

2. Organisation

2.1 General

The FPC shall be operated according to a documented quality system. The manufacturer shall establish, document and maintain the FPC system to ensure that the products placed on the market comply with the declared performance of the characteristics. The records must be kept at least for a period of 3 years. All quality documentation shall be kept up to date.

2.2 Responsibility and authority

The responsibility, authority, and the interrelationships between all personnel who manage, perform, or verify work affecting quality or product conformity, shall be defined. This applies particularly to personnel who need the organizational freedom and authority to:

a) Identify procedures to demonstrate conformity of the product at appropriate stages
b) Initiate action to prevent the use and production of non-conforming product
c) Identify and record any product quality problems or non-conformities

2.3 Management representative for the FPC

At every place of production, a representative with the appropriate knowledge and production experience shall be appointed by the manufacturer and given responsibility for managing and supervising of the FPC procedures and for ensuring that the requirements of this annex are implemented and maintained.

2.4 Quality Objectives

Top management shall ensure that quality objectives regarding the production process are established at relevant functions and levels within the organization. The quality objectives shall be measurable
There shall be at least one quality objective every year.

2.5 Management review

Management shall review at least every year the FPC system to ensure its continuing suitability, adequacy and effectiveness. Records of such reviews shall be maintained. The minimum input for management review shall be at least related to the conformity of the product and include the following:

a) Status of corrective and preventive actions
b) Status of complains
c) Follow up from previous management reviews
d) Follow up of quality objectives
e) Results of audits

2.6 Training of personnel

The manufacturer shall establish and maintain procedures for the training (with a training plan and training records) of all personnel in activities affecting quality or product conformity. Personnel performing work affecting product conformity shall be qualified on the basis of appropriate education, training and/or experience, as required.

3. Quality Documentation

The manufacturer's documentation and procedures shall be relevant or appropriate to the production and process control used during manufacture of the product, and shall provide at least the following items:

a) Quality aims or policy, the organizational structure, responsibilities and authority of the management with regard to product conformity;
b) Procedures for specifying and verifying the raw materials and other constituent materials that will include having an updated list of materials of products, with documented specifications and ensuring they are in conformity with requirements
c) Manufacturer's production control and other techniques, processes and systematic actions that will be used;
d) Inspections and tests to be carried out before, during and after manufacture, together with their frequency and possible retest procedures;
e) Procedures for handling, storage, packaging, marking and labelling the product;
f) Procedures for all personnel to receive training in the activities affecting quality or conformity of the product
g) A procedure that will specify how non-complying products shall be dealt with. Any event of this kind shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.
h) A procedure for corrective actions that instigates action to eliminate the cause of non-conformities in order to prevent recurrence.
i) A procedure shall be established to define the responsibilities and requirements for planning and conducting internal audits, establishing records and reporting results(see exclusion for very small companies in chapter 8)
j) The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.
k) A procedure for control over documentation that affects the FPC
l) A procedure describing how to handle the measuring and production equipment that includes Identification of verified equipment, traceability of calibration records to national or international standards, a list of equipment and frequency of controls
m) A procedure for informing the Certification Body on any changes in the certified products

All records must be kept for at least 3 years.

4. Inspection and testing

4.1 General

All necessary facilities, equipment and personnel shall be available to carry out the inspections and tests. The manufacturer may employ, under contract, a subcontractor who has the facilities, equipment and personnel to carry out the inspection and tests on behalf of the manufacturer. The manufacturer shall be responsible for the results of control, calibration, and maintenance of testing and measuring equipment, whether owned by or on loan to the manufacturer or a subcontractor.

Inspection and testing shall be performed by personnel qualified for such tasks on the basis of documented appropriate education, training and/or experience.

4.2 Test equipment

Tests to demonstrate conformity of the finished product shall be performed using appropriate testing equipment and documented working instructions.The test equipment shall be regularly calibrated and verified.

4.3 Inspection and testing of raw materials and other constituent materials

The manufacturer shall ensure that raw materials and other constituent materials conform to his specified requirements. In determining the checks necessary consideration shall be given to the control exercised by the supplier and the documented evidence of conformity supplied (often referred to as supplier certified components or certified raw materials). There should be a proper traceability to the supplier's documentation.

Table 2 for solar collectors and table 3 for storage tanks in Chapter 9 show examples for checks on purchased products to be carried out by the manufacturer. All performed checks and tests shall be recorded in writing with traceable responsibility according to the manufacturer's procedure

4.4 Inspection and testing during manufacture and on finished product

In order to manufacture products which conform to the product standard the manufacturer shall control his process and perform inspection and tests. Examples are shown in the table 4 for collectors and table 5 for storage tanks in Chapter 9.

4.5 Inspection and test records

The results of products inspection and testing shall be recorded.
The record shall contain the product identification, the date and time of manufacture and for each property the test methods, the test results, the inspection result and the identification of the person carrying out the inspection.

5. Actions in the case of non-conforming products

If the result of a test or the inspection of a product is a failure, the manufacturer shall immediately take the steps necessary to rectify the deficiency. Products which do not conform to the requirements of the product standard, shall be marked, isolated or controlled

accordingly. When the deficiency has been identified and rectified, the test or inspection in question shall be repeated without delay accordingly to the quality documentation, to provide the evidence that the defects have been overcome. Corrective and preventive actions taken in case of non-conforming products shall be documented.

6. Handling, storage, packaging and marking of products

In accordance with the quality documentation the manufacturer shall:

a) Provide methods of handling that prevent damage or deterioration;
b) Provide suitable storage areas or stock rooms or prevent damage or deterioration of the product;
c) Control the packaging, storage and the marking processes

7. Traceability of products

Individual collectors and their main components shall be identifiable and traceable with regard to their production origin.

8. Internal audit

This clause is not mandatory for very small companies that do not have the resources to audit themselves. However this exclusion must be documented and explained in the Quality Documentation of the company. A very small company is defined as having less than10 people involved in the FPC and less than 3 levels of hierarchy.

The organization shall conduct internal audits at planned intervals of at least once a year to determine whether the quality management system

a) Conforms to the quality documentation
b) Is effectively implemented and maintained

In case of internal audit, an audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods shall be defined. The selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process. Auditors shall not audit their own work.

A document procedure shall be established to define the responsibilities and requirements for planning and conducting audits, establishing records and reporting results.

Records of the audits and their results shall be maintained.

The management responsible for the area being audited shall ensure that any necessary corrections and corrective actions are taken without undue delay to eliminate detected nonconformities and their causes.

Follow up activities shall include the verification of the actions taken and the reporting of verification results.

9. Tables for control on purchased products and on the final product and during production

Table 2: Checks on purchased productss for collectors

Material	Method	Requirement	Frequency
Pipe	Visual check and documentation check	No damage	Each delivery (1)
	Measurement	Purchase specification: pipe dimensions within tolerance	
Absorber sheet	Visual inspection	No damage	
	Document check	Purchase specification: Parameters of optical characteristics (solar absorbance and thermal emittance)	
Absorber	Visual inspection	No damage	
	Document check	Purchase specification: Parameters of optical characteristics (solar absorbance and thermal emittance) and proper connection between absorber sheet and pipes (this may be a mechanical test also)	Pressure/leakage test shall be done on 100% of absorbers- by supplier or manufacturer.
Pipe grid	Visual inspection	No damage	Each delivery
	Document check	Purchase specification	Pressure/leakage test shall be done on 100% of absorbers- by supplier or manufacturer.
Reflector material, reflector shape (if the finished reflector is delivered)	Document check or direct test for shape (eg: master shape)	Purchase specification: Solar reflectance, shape	Each delivery (document check) or less frequency if it is tested
Heat pipes	Test for check performance (may be done by heat pipe manufacturer)	Purchase specification	Variable
Heat transfer sheet	Measurement	Purchase specification	Variable (AQL should refer to ISO2859-1)
Glass tubes(assembly of absorber and glass cover)	Specific test method	Purchase specification	Variable
Glazing	Measurement	Purchase specification: dimensions and optical characteristics(solar transmittance)	Each delivery (1)
	Document check or direct test	If only a document check is done, then there must be a special agreement to assure optical characteristics	
Insulation	Visual	No damage	Each delivery
	Document check	Purchase specification: density and thermal conductivity	Each delivery
	Weight measurement	Manufacturer's method	Each delivery (1)

	Dimension measurement		
	Outgasing test (only for flat plate collectors)		
Casing			
Material of frame elements	Visual check	Purchase specification	Each delivery (1)
	Measurement (verify product is inside tolerance)		
Material of rear panel	Visual check	Purchase specification	Each delivery (1)
	Measurement (verify product is inside tolerance)		
Hydraulic connections	Visual Check Measurement (verify product is inside tolerance)	Purchase specification	Each delivery (1)
Sealant	Documentation and Visual check	Purchase specification	Each delivery (1)

Table 3: Checks on incoming goods for storage tanks

Components		Method	Requirements	Frequency	Comments
Storage tank	All types	General appearance Dimensional	In accordance with specifications	On each unit for the manufacturer On each batch delivery in case of subcontracting	The subcontractor shall provide a record of the checks performed on the tanks
		Tightness	Using water : 1.3 times the stated service pressure - Using air : Pressure according to manufacturer specification	On each unit On each unit	
	Stainless steel type	Anticorrosion treatment of welds	In accordance with specifications	On each unit	
	Internal protective coating by enamelling type	Monitoring of oven temperature		Continuous	
		Monitoring of oven temperature Homogeneity Or Destructive control to check enamel quality		Continuous Weekly	

		Monitoring of oven time		Continuous	
		Coating thickness		By sampling	
		General appearance		On each unit	
	Other type of protective coating	Coating thickness	In accordance with specifications	On each unit	
		General appearance			

Components	Method	Requirements	Frequency	Comments
Manufactured insulation	General appearance	In accordance with specifications	On each batch delivery by sampling	Test is performed by the supplier if the manufacturer do not have the right equipment
	Dimensional			
	Density or thermal conductivity			
Storage tank *(Subcontracted intermediate product)*	General appearance	In accordance with specifications	On each batch delivery	The subcontractor shall provide a record of the checks performed on the cylinders
	Dimensional			
	Leaktightness	Using water : 1.3 times the stated service pressure - Using air : according to manufacturer specification	On each unit On each unit	

Note 1: In this case, the frequency of checks may be decreased in result of reliability of the supplier (ISO 9001 certificate etc.) and history of deliveries (no complaints, no non-conformities). In this case a written procedure shall exist, describing the rules for decreasing the frequency and return to full-check in case of non-conformities.

Table 4. Inspection and tests on collectors

Process	Method	Requirement	Frequency
Cutting of pipe	Measurement	Manufacturer specification for dimensions	At the beginning of each production order (2)

Cutting of absorber sheet	Measurement	Manufacturer specification for dimensions	At the beginning of Each production order (2)
Cutting of frames	Measurement	Manufacturer specification for dimensions	At the beginning of Each production order (2)
Connection of pipe to absorber	Visual	Proper welding	Each absorber
	(Recommended but not obligatory) mechanical test with manufacturer's method		Manufacturer's specification
Absorber	Visual check	No damage	Each absorber
Reflector material	Visual	No damage	Each collector
Assembly	Visual	Proper assembly	Each collector
Sealing	Visual	Proper sealing	Each collector
Leakage	Manufacturer method for pressure test	Manufacturer method	Each collector
Release of each collector	Visual or manufacturer's method	Manufacturer method	Each collector

Table 5. Inspections and tests on storage tanks

Components		**Method**	**Requirement**	**Frequency**	**Comments**
Storage tank	All types	General appearance Dimensional	In accordance with specifications	On each unit for the manufacturer On each batch delivery in case of subcontracting	The subcontractor shall provide a record of the checks performed on the tanks
		Tightness	Using water : 1.3 times the stated service pressure - Using air : Pressure according to manufacturer specification	On each unit On each unit	
	Stainless	Anticorrosion	In accordance	On each unit	

	steel type	treatment of welds	with specifications		
	Internal protective coating by enamelling type	Monitoring of oven temperature		Continuous	
		Monitoring of oven temperature Homogeneity Or Destructive control to check enamel quality		Continuous Weekly	
		Monitoring of oven time		Continuous	
		Coating thickness		By sampling	
		General appearance		On each unit	
	Other type of protective coating	Coating thickness	In accordance with specifications	On each unit	
		General appearance			

Components	Method	Requirement	Frequency	Comments
Manufactured insulation	General appearance	In accordance with specifications	On each unit	
	Dimensional			
	Density or thermal conductivity			
Insulation produced by injection	Injection time	In accordance with specifications	By periodic sampling, after prolonged stoppage and change of injection products	The storage conditions of Isocyanate and Polyol components shall comply with the supplier's instructions.
	Temperature/Hygrometry			
	General appearance			
	Dimensional			
	Density			

Note 2: In this case, the frequency of checks may be decreased in result of reliability of the supplier (ISO 9001 certificate etc.) and history of deliveries (no complaints, no non-conformities). In this case a written procedure shall exist, describing the rules for decreasing the frequency and return to full-check in case of non-conformities.