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 collectors.

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;
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

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 control, calibration, and maintenance of testing, measuring, and inspection 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 to the relevant product standard shall be performed using appropriate testing equipment and documented working instructions. The test equipment shall be controlled regularly by calibration or verification following the manufacturer's own instructions.

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.

This table shows the minimum checks to be carried out on incoming goods. All checks and tests shall be recorded:

Material	Method	Requirement	Frequency
Pipe	Visual check and documentation check	No damage	Each delivery
	Measurement	Purchase specification: pipe dimensions within tolerance	Each delivery (1)
Absorber sheet	Visual inspection	No damage	Each delivery
	Document check	Purchase specification: Parameters of optical characteristics (solar absorbance and thermal emittance)	
Absorber	Visual inspection	No damage	Each delivery
	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
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	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)

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.

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 as described in his manual, and complying at least with the following table.

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

Note 2: In this case, the frequency of checks may be decreased in result of reliability of previous experience. 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.

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.