



TERMS, DEFINITIONS, ABBREVIATIONS,


SYMBOLS AND UNITS

ESCC Basic Specification No. 21300

ISSUE 1

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TERMS, DEFINITIONS, ABBREVIATIONS,

SYMBOLS AND UNITS

ESA/SCC Basic Specification No. 21300

SCC

space components
coordination group

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1. SCOPE

This specification defines the terms, definitions, abbreviations, symbols and units used in the ESA/SCC Basic, Generic and Detail Specifications which together form the overall SCC System.

Terms, definitions, abbreviations, symbols and units used for, and applicable to, individual components only are defined in ancillary Detail Specifications belonging to the 21300 series of specifications (see Section 4).

Each Detail Specification shall be read in conjunction with this specification.

2. TERMS AND DEFINITIONS FOR GENERAL PURPOSES

2.1 BASIC TERMS

2.1.1 Classification

Family of Components

- A group of components which display a particular and predominant physical characteristic and/or fulfil a specific function.

Family of Structurally Similar Components

- A family of components that are structurally similar, but separately identifiable, covered by a single Detail Specification.

Such components shall be produced by one Manufacturer, consist of essentially the same materials and be manufactured according to the same basic design, processes and techniques. They shall differ only in electrical characteristics.

Subfamily of Components

- A group of components belonging to the same component family and produced according to similar technological methods.

Type and Style

- Type and style of a specific component are defined in the relevant Detail Specification.

Capability Domain

- A set of defined technologies subjected to Capability Approval review and limited by the capability boundaries.

Capability Boundary

- One of the electrical, physical or mechanical parameters, design rules, materials, equipment or software forming the limits of the capability domain. These boundaries are proved initially and defined, by the Manufacturer, in the Process Identification Document.

2.1.2 Specifications

Specification

- A document containing the rules and requirements, including inspection procedures, applicable to component procurement.

Basic Specification

- Such specification is applicable to all component families or a large group of components to the extent specified in the applicable Generic or Detail Specification.



- Generic Specification
- A specification applicable to a family or subfamily of components and containing all those requirements that are common to a component family or subfamily.
- Detail Specification
- A specification derived from a Generic Specification which covers a particular component or a recognised range of components. It describes that component, or range of components, together with rated and/or limit values and characteristics. A Detail Specification also includes inspection requirements or refers in respect of such requirements to the applicable Generic Specification.
- 2.1.3 Procedure
- Approval of a Manufacturer
- A procedure which results in the recognition that a Manufacturer has a competent organisation for the production and inspection of particular components in accordance with the requirements laid down in ESA/SCC Basic Specifications.
- Qualification Approval
- Qualification approval is the decision by the proper authority that a particular Manufacturer can be considered as able to produce reasonable quantities of the component type which meets the specification requirements.
- Raw Material Lot
- The material has to be manufactured:
 - With the same process, specifications and procedures.
 - With the same equipment.
- Diffusion Lot
- Wafers shall be processed within an uninterrupted period of 6 weeks:
 - With wafer raw material from the same crystal.
 - With the same process, specifications and procedures (diffusion).
 - With the same design, construction and geometry (mask).
 - With the same equipment.
- Piece Parts Lot
- The piece parts have to be manufactured:
 - With the same process, specifications and procedures.
 - With the same design, construction and geometry.
 - With the same equipment.



Assembly Lot	<ul style="list-style-type: none">- An assembly lot is a quantity of components or family of structurally similar components which, as well as their piece parts are manufactured:<ul style="list-style-type: none">- With semiconductor dice out of one diffusion lot.- With basic raw material out of one raw material lot.- With piece parts out of one piece parts lot.- Through to the end of Final Production Tests.- With the same process, specifications and procedures.- With the same design, construction and geometry.- With the same equipment.
Inspection Lot	<ul style="list-style-type: none">- A quantity of components presented for inspection and submission to lot-by-lot testing in accordance with the sampling document.
Delivery Lot	<ul style="list-style-type: none">- A quantity of components delivered against an order and originating from the same assembly lot. It can include flight parts and Qualification/Lot Acceptance Test samples.
Selected Sublot	<ul style="list-style-type: none">- A portion of an assembly lot, if the assembly lot comprises more units than are required for mechanical, environmental and endurance tests and delivery. A selected sublot shall consist of a minimum of the components necessary for delivery, test sublot and allowable failures during burn-in. More than one selected sublot can be extracted from an assembly lot.
Test Sublot	<ul style="list-style-type: none">- A test sublot consists of those components that are required for the performance of mechanical, environmental and endurance tests according to the applicable Generic Specification. Such components shall be randomly taken from a selected sublot after successful completion of burn-in and parameter drift screening.
Deliverable Components	<ul style="list-style-type: none">- Components to be delivered shall be processed and inspected according to the production flow chart and shall pass all tests specified for the required testing level.
Certificate of Conformity	<ul style="list-style-type: none">- A document issued with a delivery lot, stating that the components have been taken from one or more inspection lots released in conformity with ESA/SCC basic rules.
Mark of Conformity	<ul style="list-style-type: none">- A mark applied to the packing and/or component, indicating that the components originate from an inspection lot which has been released in accordance with ESA/SCC basic rules.



Capability Approval	- An approval granted to a Manufacturer when it has been established that his capability for design, manufacture and quality control of products, within a defined technological domain, fulfils ESA/SCC requirements.
Chip Component	- A component in its ultimate state of miniaturisation.
Test Structure	- An element or component specifically intended to test one or more Parametric boundaries of the capability domain and used in testing to obtain Capability Approval.
2.2	<u>RELIABILITY CONCEPTS</u>
2.2.1	<u>Reliability</u>
Reliability (general definition)	- The ability of an item to perform a required function under stated conditions and for a stated period of time.
Reliability (probability definition)	- The characteristic of an item expressed by the probability that it will perform a required function under stated conditions and for a stated period of time.
2.2.2	<u>Failure Concepts</u>
Failure	- The termination of the ability of an item to perform its required function, or excessive change of any characteristic of an item, or the loss of traceability of an item. A failure may be effected by inherent weakness of a component during operation or storage within rated conditions, or by wrong handling of a component, of insufficient or wrong documentation during manufacturing, testing, storage or shipping.
Failure Mode	- The effect by which a failure is observed.
Sudden Failure	- A failure that could not be anticipated by prior examination.
Gradual Failure	- A failure that could be anticipated by prior examination.
Partial Failure	- A partial failure shall be identified as a drift or limit failure.
Drift Failure	- A failure resulting from deviation in characteristic(s) beyond the specified parameter drift values, during burn-in and parameter drift screening tests, but not causing complete failure of the required function.
Limit Failure	- A failure resulting from deviation in characteristic(s) beyond the specified limits and causing failure of the required function.



Complete Failure	- A failure resulting from deviations in characteristic(s) beyond specified limits causing loss of the required function.
Catastrophic Failure	- A failure which is both sudden and complete.
Degradation Failure	- A failure which is both gradual and partial.
Early Failure Period	- The early stages of a period which starts at a specified point in time and during which the failure rate decreases rapidly.
Constant Failure Rate Period	- A period during which it is possible that failures occur at an approximately uniform rate.
Wear-out Failure Period	- A period during which it is possible that the failure rate increases rapidly due to deterioration processes.
Mean Failure Rate	- A quantity of items which is related to a time unit and which, having survived up to an arbitrary instant, are no longer active at the instant $t + \Delta t$. The instantaneous mean failure rate is equal to the density of the conditional probability of failure.
Mean Time to Failure - MTTF	- For truncated tests and during a defined life period of an item, the sum of the operating time of a population, divided by the total number of failures in the population during the period in given stress conditions (cumulative operating time is a product or sum of products).
Mean Time Between Failures -MTBF	- For a stated period in the life of an item, the mean value of the duration of operating times between consecutive failures under given stress conditions.
Mean Life Observed	- Mean value of observed times to failure of all the individuals in a population of items under stated conditions.
Failure Analysis - FA	- The logical, systematic examination of an item or its diagram(s) to identify and analyse the probability, causes and consequences of potential and real failures.
Defect	- The nonfulfillment of an intended ESA/SCC requirement or a reasonable expectation, for the use of a component, including one concerned with safety.
Minor Defect	- A defect that is not likely to reduce materially the usability of the unit of product for its intended purpose or its departure from established standards, having little bearing on the effective use or operation of the unit.
Minor Defective	- A unit of product that contains one or more defects, but contains no critical or major defect.



Non-conformance

- The failure of a unit of product to conform to specified requirements for any quality characteristic.

2.2.3 Test Concepts

Qualification Test

- Qualification of a product is a complete series of tests carried out on a number of specimens representative of the type with the object of determining whether a particular Manufacturer can be considered capable of manufacturing products which meet the specification.

Screening Test

- A test, or combination of tests, intended to remove unsatisfactory items or those likely to exhibit early failures.

Burn-in

- Non-destructive testing to stabilise the characteristics of an assembly lot and to screen good parts without either effective or potential failures.

Final Production Test - FPT

- All test and measurement operations which are performed on all of the assembled (finished) components.

Environmental and Endurance Tests

- The testing (destructive or non-destructive) of samples for product qualification purposes. Such testing may include:
 - Shock.
 - Vibration.
 - Constant acceleration.
 - Seal.
 - Weldability.
 - Solderability.
 - Thermal shock.
 - Moisture resistance.
 - Terminal strength.
 - Electrical measurements.
 - Operating life.
 - High temperature storage.

Extended Endurance Test

- Extended endurance tests are tests required to obtain information about the reliability of a component. They may include:
 - Operating life, i.e. 10 000 hours
 - High temperature storage for a long time, i.e. 10 000 hours.

Destructive Physical Analysis - DPA

- Determination of the type and quality of materials, technology and processes used by a Manufacturer in the production of a particular component to establish its suitability for Space applications, or to maintain the standard of approved materials, technology and processes.

2.3 QUALITY ASSURANCE TERMS

**2.3.1 General**

- Quality** - The totality of characteristics of an item or component that bear on its ability to satisfy stated and implied needs.
- Quality Assurance - QA** - A planned and systematic pattern of all actions necessary to provide adequate confidence that the item or product conforms to established technical requirements.
- Quality Control - QC** - A management function whereby control of quality of raw or produced material is exercised for the purpose of preventing production of defective material.
- Qualification** - The entire process by which products are obtained from Manufacturers or Distributors, examined and tested, and then identified in Qualified Product Lists.
- Qualified Part** - A component type which has been demonstrated to meet the ESA/SCC requirements for inclusion in the ESA/SCC Qualified Parts List.
- Safety** - The state in which the risk of harm (to persons) or damage arising from component handling or intended use is limited to an acceptable level.

2.3.2 Statistics, Sampling and Testing

- Acceptable Quality Level (A.Q.L.)** - The maximum percentage of defectives (or the maximum number of defects per 100 units) which, for the purpose of sampling inspection, can be considered satisfactory as a process average.
- Acceptance Number** - The maximum number of defects or defective units in a sample that will permit acceptance of the inspection lot or batch.
- Rejection Number** - The minimum number of defects or defective units in a sample that will cause rejection of the lot represented by the sample.
- Defects per 100 Units** - The number of defects per 100 units of any given quantity of a product is the number of defects contained therein divided by the total number of units of product, the quotient multiplied by 100 (1 or more defects being possible in any unit of product). Expressed as an equation:-
$$\text{Defects per 100 units} = \frac{\text{Number of defects} \times 100}{\text{Number of units}}$$
- Inspection Level** - An indication of the relative sample size for a given amount of product.
- Inspection Tightened** - Inspection under a sampling plan using the same quality level as for normal inspection, but requiring more stringent acceptance criteria.



- Reduced Inspection - Inspection under a sampling plan, using the same quality level as for normal inspection, but requiring a smaller sample for inspection.
- 100% Inspection - Inspection in which specified characteristics of each unit of product are examined or tested to determine conformance to requirements.
- Percent Defective Allowable - PDA - The allowable percent defective of any given quantity of units of product is 100 times the number of defective units of product contained therein divided by the total number of units of product, i.e.:-

$$\text{Allowable percent defective} = \frac{\text{Number of defectives} \times 100}{\text{Number of units inspected}}$$

- Process Average - Is the average percentage of defective or average number of defects per 100 units of product submitted by the supplier for original inspection.
- Lot or Batch - The term lot or batch shall mean "inspection lot" or "inspection batch", i.e. a collection of electronic components from which a sample is to be drawn and inspected to determine compliance with the acceptability criteria, and may differ from a collection of electronic components designated as a lot or batch for other purposes (e.g. production, shipment, etc.).
- Lot Size - The number of units of product in a lot.
- Sample - A sample consists of 1 or more electronic components from a lot or batch, the units of the sample being selected at random. The number of electronic components in the sample is the sample size.
- Sample Size - The number of units of product in the sample selected for inspection.
- Sample Unit - A unit of product selected to be part of a sample.
- Unit of Product - A unit of product is the thing inspected in order to determine its classification as defective or non-defective or to count the number of defects. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may, or may not, be the same as the unit of purchase, supply, production or shipment.
- Sampling Frequency - The sampling frequency 'f' is the ratio between the number of units of product randomly selected for inspection at an inspection to the number of product passing the inspection station.



Sampling Plan	- A statement of the sample size or sizes to be used and the associated acceptance and rejection criteria.
Resubmitted Lot	- A lot which has been rejected, subjected to either examination or testing, or both, for the purpose of removing all defective units which may or may not be reworked or replaced, and submitted again for acceptance.
Testing	- Is an element of inspection and generally denotes the determination by technical means of the properties of elements of supplies, or components thereof, including functional operation, and involves the application of established scientific principles and procedures.
Testing Levels	- Testing levels are identifiable qualities of components arrived at by prescribing the determination of testing. Testing level 'B' is the highest defined level.
2.3.3 <u>Inspection</u>	
Calibration	- Comparison of 2 instruments or measuring devices, 1 of which is a standard of known accuracy traceable to national standards, to detect, correlate, report or eliminate by adjustment any discrepancy in accuracy of the instrument or measuring device being compared with the standard.
Measuring and Test Equipment	- All devices used to measure, gauge, test, inspect, diagnose or otherwise examine materials, supplies and equipment to determine compliance with technical requirements.
Attribute	- A characteristic or property which is appraised in terms of whether it does or does not exist (e.g. go or not go) with regard to a given requirement.
Inspection	- The examination and testing of supplies and services (including, when appropriate, raw materials, components and intermediate assemblies) to determine whether they conform to specified requirements.
Lot-by-lot Inspection	- Lot-by-lot inspection is that inspection carried out on each lot either on a sample drawn from the lot or on the complete lot. The results of tests in this category are used to determine whether the lot complies with the specified requirements.
Periodic Inspection	- Periodic inspection is that inspection carried out periodically on a sample drawn either from an individual lot or from a number of lots. The lot(s) from which the sample is drawn shall have been shown to comply with the requirements for lot-by-lot inspection. The results from tests in this category are used to verify that the level of technical performance is being maintained.



- | | |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inspection by Attribute | - Inspection whereby either the unit of product or characteristic thereof is classified simply as defective or non-defective, or the number of defects in the unit of product is counted, in respect of a given requirement. |
| Inspection by Variables | - Inspection wherein certain quality characteristics of sample are evaluated in respect of a continuous numerical scale and expressed as precise points along this scale. Variables inspection records the degree of conformance or non-conformance of the unit with specified requirements for the quality characteristics involved. |
| Inspection In-process | - Inspection which is performed during the manufacturing or repair cycle in an effort to prevent defectives from occurring and to inspect the characteristics and attributes which are not capable of being inspected at final inspection. |
| Examination | - An element of inspection consisting of investigation, without the use of special laboratory appliances or procedures, of supplies and services to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally non-destructive and includes, but is not limited to, visual, auditory, olfactory, tactile, gustatory and other investigations; simple physical manipulations; gauging; and measurement. |
| Traceability | - The means of knowing at all times during production or a specific period of utilisation of a component any historical detail of each production and reliability processing step, starting from the raw materials source, the inspector or worker, the state of the machine, etc. |
|
 | |
| 2.3.4 <u>Documents</u> | |
| Inspection Record | - Recorded data concerning the results of inspection action. |
| Deviation | - Written authorisation, granted prior to the manufacture of an item, to depart from a particular performance or design requirement of a contract, specification or referenced document, for a specific number of units or specific period of time. |
| Waiver | - A written authorisation to accept a configuration item or other designated items which, during production or after having been submitted for inspection, are found to depart from specified requirements, but nevertheless are considered suitable for use "as is" or after rework by an approved method. |
| Inspection Quality Conformance | - All examinations and tests performed on items or services for the purpose of determining conformance with specified requirements. |



Certificate of Conformance	<ul style="list-style-type: none">- A Contractor's written statement, when authorised by contract, certifying that supplies or services comply with contract requirements.
Production Flow Chart	<ul style="list-style-type: none">- The production flow chart is a drawing which shows the overall processing and testing, the manufacturing sequences of a particular part of production line, including inspection and process control points. <p><u>N.B.</u> Essential elements of the production flow chart are as follows:</p> <ul style="list-style-type: none">- Raw materials.- Processing steps.- Inspection. <ul style="list-style-type: none">- Reference to all corresponding specifications with revision letter or number.
Overall Flow Chart	<ul style="list-style-type: none">- The overall flow chart is a drawing which includes a simplified production flow chart, sequences of testing operations, indication of recorded data and documents to be delivered.
Qualified Parts List - QPL	<ul style="list-style-type: none">- The qualified parts list is a list of components and materials accepted under the SCC Specification System, including the names and plant addresses of Manufacturers or distribution.
Survey, Product-oriented	<ul style="list-style-type: none">- A review and evaluation to determine the adequacy of the technical requirements relating to quality and product conformance to design intent.
Authorised Representatives	<ul style="list-style-type: none">- Representatives authorised in accordance with the Space Agency rules to act on its behalf in the National and European component fields.
Qualifying Space Agency - QSA	<ul style="list-style-type: none">- The qualifying space agency is the national authority recognised by the SCCG inspection authority.
Process Identification Document - PID	<ul style="list-style-type: none">- A Process Identification Document comprises all documents relevant to the manufacture of a specific component. It shall include, as a minimum:-<ul style="list-style-type: none">(a) The production flow chart.(b) All process specifications.(c) All inspection procedures.(d) Constructional details of the component, including photographs where applicable.(e) The test programme.(f) An organigram of the Manufacturer's organisation.

**Capability Abstract**

- A comprehensive synopsis of a capability domain in terms of technology boundaries, circuit function and performance, construction rules, package and design data etc. The document shall have no commercial sensitivity, thus rendering it suitable for inclusion in the Qualified Products List.

2.4 IRRADIATION TERMS**2.4.1 Irradiation In Orbit**

The main influence on electronic components will be caused by:

- High energy electrons.
- Protons.
- Heavy ions.
- X-ray.
- Gamma ray.

2.4.2 Irradiation Resistance Testing

To assure the correct behaviour of a semiconductor device in a Space radiation environment, it is advisable to check its vulnerability to this environment by radiation stress testing in the laboratory. An exact radiation profile with all its different components and wide energetic spectrum cannot be duplicated in the laboratory. Instead of this, the influence of the radiation species, their energy and also the influence of the response of the semiconductor material and technology can be determined by experiments.

Though the particle type and dose rate, that may prevail, are disregarded, it is possible to determine behaviour under irradiation by dosage from a single radiation source. The effects of such a total dose bear a rough approximation to actual conditions for doses from approximately 1kRad up to 1MRad.

2.4.3 The Basic Definitions

The source of these definitions, units and parameters that are internationally accepted is IEC Publication 50:

- RAD : A dose of one RAD imparts 100 ERG of ionising excitation energy per gramme of material irradiated; 1 RAD (Si) = 100 ERG/g (Si).
- GRAY (GY) : 1 Joule/kg (100RAD).
- DOSE LEVEL : In RAD (material); 1RAD (Si) = 100 ERG/g (Si).
- DOSE RATE : In RAD (material)/sec.
- FLUENCE : Particles/cm².
- FLUX : Particles/cm²/sec.

2.4.4 Expressions used in ESA/SCC Basic Specification No. 22900

- Co 60 Source: A source with a steady state dose.
- Steady State Irradiation Testing: Testing the irradiation resistance of a component under a steady state (non-pulsating) source (A Cobalt 60 source for example).



- Total Dose Ionising Radiation: The amount of radiation that is absorbed by the component under test, expressed in RAD (Si) or GRAY (Si).
- In-situ Testing: Electrical testing of the component on the location where the component is irradiated.
- Remote Testing: Electrical testing of the component on another location than where the component is irradiated.
- Dosimetry: A method to measure the deposited energy or particle fluence in order to quantify the steady state radiation exposure.
- Faraday Cup: The most widely used instrument for monitoring the FLUX and FLUENCE and for absolute determination of charged particle fluxes. The total charge built up on the Faraday Cup divided by the charge per particle gives the total number of particles which have fallen on the cup.
- Device Biasing: The device under test has an outside voltage supplied during irradiation exposure.
- Unidirectional Incident Radiation: Exposure to a parallel (collimated) beam of radiation.
- Corrections for Source Decay: The irradiating source will change its fluence in time. Co-60 sources have a decrease with a half life of approximately 5 years.
- Annealing: Recovery of certain devices after removal of the irradiation source. This recovery to normal situation is called annealing.

3. ABBREVIATIONS, SYMBOLS AND UNITS FOR GENERAL PURPOSES

3.1 CURRENTS, VOLTAGES AND POWERS

I, i	= Current	A	= Ampère
V, v	= Voltage	V	= Volts
P, p	= Power	W	= Watts

3.2 SUBSCRIPTS

AV, av	= Average
F, f	= Forward.

3.3 LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

<u>Symbol</u>	<u>Definition</u>	<u>Unit</u>
B, b	= Susceptance	mhos
C	= Capacitance	Farad
G, g	= Conductance	mhos
H, h	= Hybrid parameter	
L	= Inductance	Henry
R, r	= Resistance	Ohm
X, x	= Reactance	Ohm
Y, y	= Admittance	mhos
Z, z	= Impedance	Ohm.

3.4 SUBSCRIPTS FOR ELECTRICAL PARAMETERS

I, i	= Input
O, o	= Output.

**3.5 LETTER SYMBOLS FOR TEMPERATURE**

amb	=	Ambient
case	=	Case
J, j	=	Junction
stg	=	Storage
R _{th}	=	Thermal Resistance
op	=	Operating.

3.6 OTHER SYMBOLS

t	=	Time
f	=	Frequency
B	=	Bandwidth
d	=	Distortion
F	=	Noise figure
G	=	Gain
T	=	Temperature.

3.7 STANDARD VALUES

The standard values for 'E' ranges are shown in Appendix 'A'.

When an 'E' range is specified for a Range of Components in a Detail Specification, all values within the indicated range are available, within the limits specified.

The tolerance on values within each individual 'E' range will be as shown in Appendix 'A', unless otherwise stated in the Detail Specification.

4. ANCILLARY DETAIL SPECIFICATIONS

The following supplementary specifications have been issued:-

ESA/SCC 2133000	-	Terms, Definitions, Abbreviations, Symbols and Units for Capacitors.
ESA/SCC 2133400	-	Terms, Definitions, Abbreviations, Symbols and Units for Electrical Connectors.
ESA/SCC 2133600	-	Terms, Definitions, Abbreviations, Symbols and Units for Electromagnetic Relays.
ESA/SCC 2134000	-	Terms, Definitions, Abbreviations, Symbols and Units for Resistors.
ESA/SCC 2135000 (1)	-	Terms, Definitions, Abbreviations, Symbols and Units for Discrete Non-Microwave Semiconductor Devices.
ESA/SCC 2139000	-	Terms, Definitions, Abbreviations, Symbols and Units for Integrated Circuits.
ESA/SCC 2139020	-	Terms, Definitions, Abbreviations, Symbols and Units for Charge Coupled Devices.

NOTES

1. For Discrete Microwave Semiconductor Devices (ESA/SCC Generic No. 5010), no individual ancillary specification for Terms, ... exists. ESA/SCC 2135000 should be used to the extent applicable.



APPENDIX 'A'

STANDARD VALUES LIST

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%				
100	100	100	100	100	100				
				101	101				
				102	102				
			104	104					
			105	105	105	105	105		
						106	106		
						107	107		
			109	109	110	110	110	110	
			111	111					
		113	113						
		114	114						
		115	115	115		115	115		
						117	117		
					118	118			
		120	120	120	121	121	121		
	124	124	124			124	124		
						126	126		
					127	127			
	130	130	130		130	130	130		
						132	132		
						133	133		
			137		137	137	137	137	
							138	138	
							140	140	
	140	140	140		140	140	140		
						142	142		
				143	143	143	143	143	
145							145		
147	147	147	147	147	147				
				149	149				
				150	150				
150	150	150	154	154	154				
				156	156				
				158	158				
			160	160	162	162	162	162	
			165	165			165	165	165
								167	167
		169			169				
		169	169	169	169	169	169		
						172	172		
	174					174			
	176				176	178	178	178	178
	180				180				
	182				182				
	187	187	187	187	187	187			
					189	189			
191					191				
193				193	196	196	196	196	
198				198					
200				200					
205	205	205	205	205	205				
				208	208				
				210	210				
			213	213	215	215	215	215	
			218	218					

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%					
220	220	220	220	221	221					
				223	223					
				226	226					
			229	229	240	237	237	237		
			232	232			232	232	232	
								234	234	
						243		243		
			249	249		249	249	249		
							252	252		
		255			255					
		258	258	270	261	261	261			
		264	264			264	264	264		
							267	267		
					271		271			
		274	274		274	274	274			
	277					277				
	280					280				
	287	287	287		287	287	287			
						291	291			
						294	294			
					298	298	300	301	301	301
					305	305				
				309	309					
	316	316	316	316	316	316				
					320	320				
				324	324	324	324	324		
							328	328		
332	332	332	332	332	332					
				336	336					
				340	340					
348	348	348	348	348	348					
				352	352					
				357	357					
365	365	365	365	365	365					
				370	370					
				374	374					
			379	379	383	383	383	383		
			388	388						
			392	392						
390	390	390	390	392	392					
				397	397					
				402	402					
			407	407	407	407	407			
						412	412			
						417	417			
422	422	422	422	422	422					
				427	427					
				432	432					
			442	442	442	442	442	442		
							448	448		
							453	453		
459	459	459	459	459	459					
				464	464					
				470	470					
470	470	470	470	475	475					
				481	481					

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%				
680	680	680	680	681	681				
				687	687				
				698	698				
			706	706	715	715	715	715	
			732	732			732	732	732
								741	741
						750		750	
			759	759		759	759	759	759
								768	768
		777			777				
		787			787		787	787	787
								796	796
								806	806
		820	820	820	825	825	825		
						835	835		
	845					845			
	856				856	856	856	856	
							866	866	
							876	876	
	887	887	887	887	887	887			
					898	898			
					909	909			
				910	910	910	910	909	909
								920	920
								931	931
	931	931	931	931	931	931			
					942	942			
949					949				
953				953	953	953	953	953	
							965	965	
							976	976	
988	988	988	988	988	988				