CHANGE TO / TENDER RFQ

Tender No: GMR-14323

Vendor No: 11001386

BOARD LIST
BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT
2000

Purchaser : Elijah Manana
Telephone : 011 584 1143
Fax Number: .

Please quote reference:
K64/6000603561

Deliver to:
TFR Head Office
Supply Chain Services
2000 Johannesburg

Closing Date :26.06.2014
Validity Date :08.05.2014
RFQ No :6000603562
End of Validity :28.08.2014

Currency: ZAR

RFQ/TENDER: CRAC/GMR/14323

SUPPLY OF STRAIN GAUGE MATERIALS AT TRANSNET- GEORGE GOCH DEPOT FOR A PERIOD OF THREE MONTHS
ISSUED: 20 JUNE 2014

CLOSING DATE: 26 JUNE 2014
CLOSING TIME: 10:AM

TECHNICAL ENQUIRIES: NELSON TAPALA 078 097 9360 OR 011 026 3601

BIDDER/S ARE HEREBY INVITED TO QUOTE AND SUBMIT QUOTATION/S AT INYANDA HOUSE 1, 21 WELLINGTON ROAD, PARKTOWN-JOHANNESBURG, NOT LATER THAN THURSDAY 26 JUNE 2014 AT 10:00 AM.

RETURN OF QUOTATION/S PLEASE FAX: 011 774 9129 OR 774 9186 OR
E-MAIL TO: thuli.mathebula@transnet.net.
HAND / POST / COURIER:TENDER BOX IS OPEN FOR SEVEN DAYS PER WEEK FOR THE RFQ/TENDERS AND QUOTATIONS SUBMISSION.

QUOTATION/S MUST BE SUBMITTED PUNCTUALLY AT 10:00 ON THE CLOSING DATE AND LATE QUOTATIONS WILL

1.1 QUOTATION/S MUST BE SUBMITTED PUNCTUALLY AT 10:00 ON THE CLOSING DATE AND LATE QUOTATIONS WILL NOT BE CONSIDERED

1.2 IF DELIVERED BY HAND:

DATE: ..... SIGNATURE OF TENDERER(S): ....

CONTACT PERSON: ..... TEL No: .....

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

TRANSNET FREIGHT RAIL, SUPPLY CHAIN SERVICES
GROUND FLOOR
INYANDA HOUSE 1
21 WELLINGTON ROAD
PARKTOWN
2193

2. CONDITIONS:

2.2 ANY PURCHASE ORDER PLACED AS A RESULT OF YOUR QUOTATION WILL BE SUBJECT TO THE STANDARD TERMS AND CONDITIONS OF CONTRACT, FORM US7(LATEST), GENERAL TENDER CONDITIONS, FORM CSS5 (LATEST) AND CONDITIONS MENTIONED HEREIN.

2.3 TENDERERS MAY OFFER AN EARLIER VALIDITY DATE, BUT THEIR QUOTATION MAY, IN THAT EVENT, BE DISREGARDED FOR THIS REASON.

2.4 TENDERERS ARE REQUIRED TO OFFER ONLY FIRM PRICES. PRICES SUBJECT TO REVIEW IN TERMS OF CLAUSE 32 OF FORM US7 WILL ONLY BE CONSIDERED SHOULD THE DELIVERY PERIOD REQUIRED EXCEED 6 MONTHS.

2.5 BEST DELIVERY TIME MUST BE OFFERED.

2.6 DISCOUNT (TRADE DISCOUNT),VALUE ADDED TAX (VAT) MUCH BE SHOWN SEPARATELY.

2.7 TRANSNET RESERVES THE RIGHT TO NEGOTIATE PRICES AND COMMERCIAL ASPECTS AFTER THE CLOSING DATE OF THE QUOTATION.

2.8 DIRECT DELIVERY INTIMATES DELIVERY BEING EFFECTED INTO THE WAREHOUSE OR THE ACTUAL POINT OF SUPPLY AND SHOULD THEREFORE INCLUDE ANY TRANSPORTATION MODE DEEMED NECESSARY IN EXECUTING THIS METHOD OF DELIVERY BASIS IN ORDER TO MEET THE REQUIRED DELIVERY DATE.

EVALUATION CRITERIA:
STAGE 1: ADMINISTRATIVE RESPONSIVENESS - MANDATORY (Failer to comply wil lead to Disqualification)
1. DELIVERY PERIOD / PROGRAMME

STAGE 2: PHASE 1 SUBSTANTIVE RESPONSIVENESS - MANADATORY, FAILURE TO COMPLY WITH REQUIREMENT WILL LEAD TO DISQUALIFICATION
1. APPROVAL FROM MANUFACTURER (HBM and Vshay measurements)
2 MATERIAL SAFETY DATA SHEETS TO BE SUPPLIED WITH GOODS

STAGE 2: PHASE 2
PRE-QUALIFICATION / FUNCTIONALITY - MINIMUM THRESHOLD 90% MUST BE MET FOR BIDDER TO PROGRESS TO STAGE 3
1 COMPLIANCE TO SCOPE OF WORK FOR THE PROJECT

STAGE 3
COMMERCIAL / PREFERENCE 80/20
. COMPETITIVE PRICING
. PROVIDE B-BBEE CERTICATE AND SCORECARD

DATE: ..... SIGNATURE OF TENDERER(S): ....

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

TAX CLEARANCE CERTIFICATES: The Regulations in terms of the Public Finance Management Act, 1999: Framework for Supply Chain Management as published in Government GazetteNo.25767 dated 5 December 2003, Clause 9 (1) (d), stipulates that the accounting authority of an institution to which these regulations apply must reject any bid from a supplier who fails to provide written proof from the South African Revenue that the supplier either has no outstanding tax obligations or has made arrangements to meet outstandingtax obligations. Tenderers will be disqualified if a valid tax clearance certificate or written proof from the South African Revenue Service that supplier has made arrangements to meet outstanding tax obligations is not submitted with the tender.
COMPANY DETAILS: NAME OF COMPANY:_____ CONTACT PERSON:_____
TEL. No._____ FAX No._____ REG. No._____ BROAD BASE BLACK ECONOMIC EMPOWERMENT (BBBEE) Transnet fully endorses and supports the Government's Broad-based Black Economic Empowerment Programme and it is strongly of the oppion that allSouth African Business Enterprises have an equal obligation to reddress the past. Transnet will therefore prefer to do business with local business enterprises who share these same values. Transnet will endeavour to do business enterprises that possess a BBBEE "recognition level" of at least a level 5. Transnet urges Tenderers (large enterprises and QSE's-see below) to have themselves accredited by any one of the various Accredition Agencies available, who do their BBBEE ratings in accordancewith the latest Codes(i.e. those promulgated on 9 February 2007) and whose names appear on the present ABVA (Association of BEE Verification Agencies)-"List of Full Members" as displayed on the ABVA website (www.abva.co.za) Although no agencies have, as yet, been accredited by SANAS (SA National Accredition System), Transnet will, in the interim, accept rating certificates of tenderers who have been verified by any of the listed agencies. Enterprises will be rated by such agency based on the Following: 1. Large Enterprises (i.e. annual turnover>R 35 million: "Rating level base on all seven elements of the BBBEE scorecard. 2. Qualifying Small Enterprises-(QSE)(i.e anual turnover>R5M but <R35m "Rating based on any four elements of the BBBEE scorecard. NB:
3. Emerging Micro Enterprises-(EME) (i.e anual turnover<R5m) are exemptedfrom being rated/verified: "Automatic rating of Level 4 BBBEE irrespective of race of ownership, i.e.100% BBBEE recognition
"Black ownership>50% or Black Women ownership>30% automatically qualifies as level 3 BBBEE, i.e. 110% BBBEE recognition.
"EME's should provide certified documentary proof of anual turnover (i.e. audited financials) plus proof of black ownership if Black ownership>50% or Black Women ownership >30% from the EME's Auditor/ Accounting Officer.
4. In addition to the above Tenderers who wish to enter into a Joint Venture or subcontract portion of the contract to BBBEE companies, must state in their tenders the percentage of the total contract value that will be allocated to such BBBEE companies should they be successful in being awarded the business. A rating certificate in respect of such BBBEE JV partners and /or sub-contractor/s, as well as a breakdown of the distribution of the aforementioned percentage must also be furnished

In view of the high emphasis which Transnet places on Broad-based Black Economic Empowerment, Transnet will allow certain preference points for BBBEE in the evaluation of all responses. Depending upon the value of the ensuing business award (i.e.below or in excess of R2m), the 80/20 or 90/10 point preference systems will be utillized where BBBEE will count out of 20 or 10 respectively in the evaluation process.

EACH RESPONDENT IS REQUIRED TO FURNISH PROOF OF THE ABOVE TO TRANSNET FAILURE TO DO SO WILL RESULT IN A SCORE OF ZERO BEING ALLOCATED FOR BBBE
Turnover: Kindly incicate your company's annual turnover for the past year R_____

DATE: ..... SIGNATURE OF TENDERER(S): ....

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

"If anual turnover<R5m, please attach certified confirmation from your Auditor/Accounting Officer
"If anual turnover>R5m please attach original or certified copy of accreditation certificate and detailed scorecard by an ABVA accreditation agency (registered as a "Full Member")

PAYMENT TERMS
The following payment terms will apply as from 1 October 2008.
"All suppliers will be paid 30 days from receipt of month and statement.
i.e. payment term F055

CONDITIONS:
This qoutation is subject to the provisions of the Standard Terms and Conditions of Contrac, Form US7, (Latest) and the General Tender Conditions, Form CSS5 (Latest) and any other standard or special conditions mentioned and/or embodied in the qoutation request.

SCHEDULE OF REQUIREMENTS
TENDERERS SHOULD INSERT THEIR PRICE/S UNDER THE APPROPRIATE HEADING HEREUNDER;
IN THIS REGARD THE TENDERER'S ATTENTION IS DIRECTED TO PARAGRAPH 16 OF FORM CSS5 (LATEST).
NB. TENDERERS OFFERING GOODS FROM IMPORTED SUPPLIES MUST SUBMIT THEIR PRICES ON THE DELIVERY BASIS APPEARING UNDER COLUMN (C) OF THIS SCHEDULE OF REQUIREMENTS.

TRANSNET INSISTS ON HONESTY AND INTEGRITY BEYOND REPRAOCH AT ALL TIMES AND WILL NOT TOLERATE ANY FORM OF IMPROPER INFLUENCING, BRIBERY, CORRUPTION, FRAUD OR ANY OTHER UNETHICAL CONDUCT ON THE PART OF BIDDERS /TRANSNET EMPLOYEES, IF, IN THE OPION OF TRANSNET,S CHIEF OPERATING OFFICER, A TENDERER/CONTRACTOR/SUPPLIER HAS OR CAUSED TO BE PROMISED, OFFER OR GIVEN TO ANY TRANSNET EMPLOYEE, ANY BRIBE, COMMISSION, GIFT LOAN, ADVANTAGE OR OTHER CONSIDERATION,TRANSNET SHALL BE ENTITLED TO REVOKE THE TENDER/CONTRACT BY FOLLOWING ITS INTERNAL POLICIES THAT GOVERN THE ECLUSION PROCESS.IN SUCH AN EVENT TRANSNET WILL BE ENTITLED TO PLACE ANY TENDERER/CONTRACTOR/SUPPLIER WHO HAS CONTRAVENED THE PROVISIONS OF TRANSNET'S BUSINESS ETHICS ON ITS LIST OF EXCLUDED TENDERERS.THIS LIST WILL ALSO BE DISTRIBUTED TO ALL OTHER STATE OWNED ENTERPRISES AND GOVERNMENT DEPARTMENTS.

TRANSNET INVITES ITS VALUED SUPPLIERS TO REPORT ANY ALLEGATIONS OF FRAUD, CORRUPTION OR OTHER UNETHICAL ACTIVITIES TO TRANSNET TIP-OFFS ANONYMOUS, AT ANY OF THE FOLLOWING ADDRESSES/ CONTACT NUMBERS:

TOLL-FREE ANONYMOUS HOTLINE-0800 003 056
EMAIL-transnet@tip-offs.com

DATE: ..... SIGNATURE OF TENDERER(S): ....

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

FAX NUMBER-0800 007 788
FREEPOST DBN 298, UMHLANGA ROCKS, 4320

ADDITIONAL INFORMATION REQUIRED:(WHERE APPLICABLE)
3.1 THE FOLLOWING ADDITIONAL INFORMATION IS REQUIRED:
(A) DISCOUNT:----------
(B) SETTLEMENT DISCOUNT:----------
(C) PRICE/S FIRM:----------
(D) PRICE/S FIRM UNTIL:----------THEREAFTER SUBJECT TO REVIEW.
(E) PRICE/S NOT FIRM:----------
(F) SABS MARK:----------
(G) SABS PERMIT NO:----------
(H) BRAND/MAKE/TYPE:----------
(I) FULL NAME AND ADDRESS OF MANUFACTURER:----------

(J) FULL NAME AND ADDRESS OF INSPECTION POINT

(K) COUNTRY OF ORIGIN:----------
(L) YEAR 2000 CONTRACT COMPLIANCE
Vendor/proposers shall indicate their year 2000 compliance with:

A. Technology Products
B. Equipment, products, components or parts
C. Products and Services

Non- compliance with either (A) or (B) shall result in your bid/ proposal being deemed non-responsive. Non-Compliance with (C) may cause you bid/proposal to be deemed non-responsive. If you indicate that none of the following apply, please provide a written justification for your determination. Transnet will review this justification and will make a final determination.

Year 2000 Compliance means that (A) the information Technology, (B) Equipment/Products/Components/Parts (Collectively Products) supplied.
(C) Products and Services contracted, will accurately process date and time data from into and between the 20th and 21th centuries. The year 1999 and 2000 and for all leap year. Process date and time includes, but is not limited to, data calculation, logistical functions, program branching, format conversion, edits and validations and the use of dates in comparasons, sorting sequencing, merging, retrieving, searching and indexing. Furthermore year 2000 compliance when (A) used in combination with other information technology, (B) used in combination with other products, (C) used in combination with their(Vendor) other date required interfaces, shall accurately process date and time data (A) if the other

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

technology, (B) If the other products, (C) either passed to or received from their other customers/suppliers, properly exchange date and time data with it/ them.

Comply:_____ Does not Comply:_____ Not Comply:_____

Justification:----------

(M) SURPLUS MATERIAL:
TENDERERS MUST INDICATE IF THEY WILL BE PREPARED TO PURCHASE BACK FROM TRANSNET ANY SURPLUS MATERIAL WHICH MAY BECOME AVAILABLE FROM ANY RESULTING PURCHASE ORDER/CONTRACT ORIGINATED FROM THE QUOTATION SUBMITTED:

(N) PAYMENT OVERSEAS:
ONLY IF TRANSNET LIMITED IS REQUESTED BY THE TENDERER TO EFFECT PAYMENT OVERSEAS DIRECT TO THE TENDERER'S PRINCIPAL/SUPPLIER THE FOLLOWING INFORMATION IS REQUIRED:
* EXCHANGE RATE ON WHICH THE QUOTATION PRICE IS BASED:R 1.00 SA CURRENCY BEING EQUAL TO---------(FOREING CURRENCY).
* PERCENTAGE IN RELATION TO THE QUOTATION PRICE TO BE REMITTED OVERSEAS:
---
* NAME OF COUNTRY TO WHICH PAYMENT IS TO BE MADE:

---
* APPLICABLE DATE OF EXCHANGE RATE:
---
* BENEFICIARY'S NAME AND FULL ADDRESS:

---
* BENEFICIARY'S BANKERS AND FULL ADDRESS:

---
* APPLICABLE ACCOUNT NUMBER:

(O) DELIVERY DATE:

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

RFQ / TENDER

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

TENDERERS MUST FURNISH THEIR ACTUAL DELIVERY AND MANUFACTURING PERIOD HEREUNDER NOTWITHSTANDING THE DELIVERY DATES SPECIFIED BY TRANSNET.

THE FOLLOWING MUST ALSO BE FURNISHED IN REGARD TO THE ABOVE:
1. PERIOD REQUIRED TO OBTAIN RAW MATERIAL.-----(DAYS)
2. MANUFACTURING PERIOD.----------(DAYS)
3. PERIOD TO TRANSPORT MATERIAL TO DESTINATION.-(DAY)

MATERIAL NO.	1.(PERIOD)	2. (PERIOD)	3. (PERIOD)

Item	Qty	Material	Description
00010	1		Strain Gauge materials

R.....
Activity

Delivery Date: 25.03.2015

FULL DETAILS OF DESCRIPTION

00020	50		RMS1

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

DATE: ..... SIGNATURE OF TENDERER(S): ....

RFQ / TENDER

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

Item	Qty	Material	Description
00030	10	X 60 A Powder	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00040	10	1.5/120LY11LY11 - STRAIN GAUGE (10X100)	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00050	10	3/120LY11 - STRAIN GAUGE (10X100)	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00060	10	1-XY41-3/120 (10X100)	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00070	10	1-XY41-6/120 (10X100)	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00080	10	1-XY91-6/120 (10X100)	

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

RFQ / TENDER

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

Item	Qty	Material	Description
00090	5	1-XY91-3/120 (10X100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00100	5	K-LY41-10/120 (10X100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00110	5	K-LY41-3/120-3-1M-wired(10x100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00120	5	K-LY41-6/120-3-1M-wired(10x100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00130	5	1-va61k2.5/350_E (10X100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

00140	5	1-XY91-6/120 wired (10X100)	R..... Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

DATE: ..... SIGNATURE OF TENDERER(S): ....

RFQ / TENDER

BOARD LIST
TRANSNET FREIGHT RAIL
PROCUREMENT DEPARTMENT

Item	Qty	Material	Description
00150	10		Flux Pens (5pcs) (5x100)

R.....
Activity

Delivery Date: 30.08.2014

FULL DETAILS OF DESCRIPTION

TOTAL AMOUNT EXC. VAT R

DATE: ..... SIGNATURE OF TENDERER(S): ....

Section 4

VENDOR APPLICATION FORM

Respondents are to furnish the following documentation and complete the Vendor Application Form below:

1. **Original** cancelled cheque **OR** letter from the Respondent's bank verifying banking details [**with bank stamp]**
2. **Certified** copy of Identity Document(s) of Shareholders/Directors/Members [where applicable]
3. **Certified** copy of Certificate of Incorporation, CM29 / CM9 [name change]
4. **Certified** copy of Share Certificates [CK1/CK2 if CC]
5. A letter on the company's letterhead confirm physical and postal addresses
6. **Original** valid SARS Tax Clearance Certificate
7. **Certified copy** of VAT Registration Certificate
8. **Certified copy** of valid Company Registration Certificate [if applicable]
9. A signed letter from your auditor or accountant confirming most recent annual turnover figures

Vendor Application Form						
Company trading name						
Company registered name						
Company Registration Number or ID Number if a Sole Proprietor						
Form of entity [√]	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor
VAT number [if registered]						
Company telephone number						
Company fax number						
Company email address						
Company website address						
Bank name			Branch & Branch code			
Account holder			Bank account number			

Respondent's Signature

Date & Company Stamp

Postal address						Code	
Physical Address						Code	
Contact person							
Designation							
Telephone							
Email							
Annual turnover range [last financial year]	< R5 m		R5 - 35 m		> R35 m		
Does your company provide	Products		Services		Both		
Area of delivery	National		Provincial		Local		
Is your company a public or private entity			Public		Private		
Does your company have a Tax Directive or IRP30 certificate			Yes		No		
Main product or services [e.g. Stationery, Consulting]							

Complete B-BBEE Ownership Details:

% Black ownership		% Black women ownership			% Disabled Black ownership		
Does your company have a B-BBEE certificate		Yes			No		
What is your B-BBEE status [Level 1 to 9 / Unknown]							
How many personnel does the firm employ	Permanent			Part time			

If you are an existing Vendor with Transnet please complete the following:

Transnet contact person	
Contact number	
Transnet Operating Division	

Duly authorised to sign for and on behalf of Company / Organisation:

Name		Designation	
Signature		Date	

TRANSNET
freight rail

TECHNOLOGY MANAGEMENT
TRACK TECHNOLOGY.

SPECIFICATION

STRAIN GAUGE MATERIALS

Author: Chief Engineering Technician Nelson Tapala
Document Control Management

Date: 12 May 2014

Circulation Restricted To:

Transnet Freight Rail
Transnet and Relevant Third Parties
Unrestricted

1. Introduction

These documents provide specification for materials to be replenished by Strain Section at George Goch. These materials are used for strain gauge applications during field testing and laboratory experimental analysis

2. Objectives

- Provide Specification that will assist on procuring materials

3. List of Material and Quantities

List		Quantity/Item	Quantity/Pack
3.1	RMS1	50	50
3.2	X60 A Powder	10	10
3.3	X60 B Liquid	20	20
3.4	1.5/120LY11 - Strain Gauges (10/Pack x100)	100	10
3.5	3/120LY11 - Strain Gauges (10/ Pack x 100)	100	10
3.6	6/120LY11 - Strain Gauges (10/ Pack x100)	100	10
3.7	1-XY41-3/120 (10/ Pack x100)	100	10
3.8	1-XY41-6/120 (10/ Pack x100)	100	10
3.9	1-XY91-6/120 (10/ Pack x100)	100	10
3.10	1-XY91-3/120 (10/ Pack x100)	50	5
3.11	K-LY41-10/120 (10/ Pack x100)	50	5
3.12	K-LY41-3/120-3-1M – Wired (10/ Pack x100)	50	5
3.13	K-LY41-6/120-3-1M – Wired (10/ Pack x100)	50	5
3.14	1-VA61K2.5/350_L (10/ Pack x100)	50	5
3.15	1-XY91-6/120 – Wired (10/ Pack x100)	50	5
3.16	Flux Rens (5 pcs) (5/ Pack x100)	50	10

4. Specifications

4.1 RMS1 – Spray

Introduction

Name: RMS1 Spray
Application: Cleaning Material or Detergent
Size: Aerosol cans á 200ml] and cleaning pads

RMS 1 is a cleaning material which is used on the Strain gauge application. RMS is manufactured

Composition/information on ingredients
Chemical characterization
. Description: Active substance with propellant.
. Dangerous components:

CAS: 67-64-1	acetone	Xi, [illegible] R 11-36-66-67	25 -50%
EINECS: 200-662-2			
CAS: 67-63-0	propan-2-ol	Xi, F; R 11-36-67	25-50%
EINECS: 200-661-7			
CAS: 106-97-8	butane) (containing ≤ 0,1 % butadiene (106-99-0))	F+; R 12	10-25%
EINECS: 203-448-7			
CAS: 74-98-6	propane	F+; R 12	10-25%
EINECS: 200-827-9			
CAS: 75-28-5	isobutane (containing ≤ 0,1 % butadiene (106-99-0))	F+; R 12	2.5-10%
EINECS: 200-857-2			

Physical and chemical properties:
General Information

Form:	Aerosol
Colour:	Colourless
Smell:	Alcohol-like
Change in condition	
Melting point/Melting range:	Not determined
Boiling point/Boiling range:	-44°C
Flash point:	-97°C
Ignition temperature:	365°C
Self-inflammability:	Product is not self-igniting.
Danger of explosion:	Product is not explosive. However, formation of explosive air/steam mixtures is possible
Critical values for explosion:	
Lower:	1.5 Vol %
Upper:	13.0 Vol %
Steam pressure at 20°C:	8300 hPa
Density at 20°C	0.70254 g/cm³
Solubility in / Miscibility with	
Water:	Fully miscible

4.2 X60 A Powder

Product identifier

Name: X60 - A
Application: Epoxy Powder
Size: 100g

Chemical characterization (Mixture)

Acrylpolymere based on methyl methacrylat with inorganic extender

Composition/information on ingredients

Mixtures

Hazardous components

CAS No	Components	Quantity
94-36-0	dibenzoyl peroxide; benzoyl peroxide	< 2.5%
84-61-7	Dicyclohexylphthalat <	2.5%

Physical and chemical properties

Information on basic physical and chemical properties

Physical state: Powder
Color: off-white
Odor: odourless

Test method

Changes in the physical state

Softening point: ~ 110 °C

Explosive dust-air mixtures may form.

Explosive properties

Density (at 20 °C): 2 g/cm³

Stability and reactivity

Stability:

Possibility of Hazardous Reactions:

Hazardous decomposition products

Possible in traces: > 150°C:
Gas/vapours, irritant.
Methyl methacrylate.

4.3 X60 B Liquid

Product identifier

Name	X60 – B
Application:	Epoxy Liquid
Size:	2 x 40mlg

Chemical characterization (Mixture)

Composition/information on ingredients

Mixtures

Hazardous components

CAS No Components Quantity

CAS No	Components	Quantity
80-62-6	methyl 2-methylprop-2-enoate methyl 2-methylpropenoate methyl methacrylate	50-100%
868-77-9 2	hydroxyethyl methacrylate	25-50%
99-97-8	N,N-dimethyl-p-toluidine	<2.5%

Physical and chemical properties

Information on basic physical and chemical properties

Physical state:	liquid
Color:	yellow
Odor:	ester

	Test method
Changes in the physical state	
Melting point:	-50 °C
Boiling point:	101 °C
Flash point:	10 °C DIN 51755
Flammability	
Solid:	not determined

Explosive properties

Explosive dust-air mixtures may form.

Lower explosion limits:	2,1 vol. %
Upper explosion limits:	12,5 vol. %
Ignition temperature:	not determined ASTM E 659
Autoignition temperature	
Solid:	not determined
Vapour pressure (at 20 °C):	40 hPa
Density (at 20 °C):	0,93 - 0,97 g/cm³
Water solubility (at 20 °C):	295 g/L

Solubility in other solvents

Soluble in:	Acetone
Viscosity / dynamic (at 20 °C):	2 mPa·s
Vapour density (at 20 °C):	>1

4.4 1.5/120LY11 - Strain Gauges

Specification for 1.5/120LY11 Strain Gauges		
SG construction		Foil SG with embedded measuring grid
Measuring grid - Grid Length - Material - Thickness	 mm µm *(microinch)*	 1.5 Constantan foil 3.8 or 5 *(150 or 197)*, depending on SG type
Carrier - Material - Thickness	 µm *(microinch)*	 Polyimide 45 ± 10 *(1.772 ± 394)*
Covering agent - Material - Thickness	 µm *(microinch)*	 Polyimide 25 ± 12 *(98[illegible] ± 472)*
Connections - length without connection leads		Nickel plated Cu leads, approx. 30 mm in Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance Resistance tolerance2) Gage factor Nominal value of gage factor Gage factor tolerance - with 1.5 mm *(0.059 inch)* measuring grid length % - with 3 mm *(0.118 inch)* measuring grid length % Temperature coefficient of the gage factor Nominal value of gage factor temperature	Ω % ± 1.5 ± 1 1/K *(1/°F)*	120 ± 0.3 without; ± 0.35 with connection leads approx. 2 Specified on each package ± 1 approx. (90 to 115 ± 10) · (10-6 / °C) coefficient Specified on each package
Reference temperature Operating temperature range - for static, i.e. zero point-related measurements - for dynamic, i.e. non-zero point-related measurements	°C (°F) °C (°F) °C (°F)	23 *(73.4)* - 70 ... + 200 *(-94...+392)* - 200 ... + 200 *(-328...+392)*
Transverse sensitivity - at reference temperature when using Z70 adhesive - on SG type LY11-6/120	 %	Specified on each package - 0.1
Temperature response Temperature response as required, adapted to coefficients of thermal expansion α for ferritic steel α for aluminum α for plastic material α for austenitic steel α for titanium α for molybdenum	 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)*	Specified on each package 10.8 · 10-6 *(6.0 · 10-6)* 23 · 10-6 *(12.8 · 10-6)* 65 · 10-6 *(36.1 · 10-6)* 16 · 10-6 *(8.9 · 10-6)* 9 · 10-6 *(5.0 · 10-6)* 5.4 · 10-6 *(3.0 · 10-6)*

α for quartz	1/K (*1/ºF*)	0.5 · 10-6 *(0.3 · 10-6)*
Tolerance of temperature response	1/K (*1/ºF*)	± 0.3 · 10-6 ± *(0.17 · 10-6)*
Temperature response with matching in the range of 3)	ºC (*ºF*)	-10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 μm/m (*microstrain*) - on SG type LY11-6/120		
at 1st load cycle and adhesive Z 70	μm/m (*microstrain*)	1
at 3rd load cycle and adhesive Z 70	μm/m (*microstrain*)	0.5
at 1st load cycle and adhesive X 60	μm/m (*microstrain*)	2.5
at 3rd load cycle and adhesive X 60	μm/m (*microstrain*)	1
at 1st load cycle and adhesive EP 250	μm/m (*microstrain*)	1
at 3rd load cycle and adhesive EP 250	μm/m (*microstrain*)	1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120		
Absolute strain value ε for positive direction	μm/m (*microstrain*)	50- 000 (5 %)
Absolute strain valueε for negative direction	μm/m (*microstrain*)	50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY11-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 μm/m and zero point drift		
- εm Δ 300 μm/m *(microstrain)*		>> 107 (test was interrupted at 107)
- εm Δ 30 μm/m *(microstrain)*		> 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads	mm (*inch*)	0.3 *(0.012)*
for SG with integrated solder tabs		
- within measuring grid area	mm (*inch*)	0.3 *(0.012)*
- within solder tabs area	mm (*inch*)	2 *(0.079)*
Bonding material than can be used		
- Cold-curing adhesives		- Z 70; X 60; X 280
- Hot-curing adhesives		- EP 150; EP 250; EP 310S

4.5 **3/120LY11 - Strain Gauges**

Specification for 3 /120LY11 Strain Gauges		
SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	3
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(98 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / *°C)*
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (*°F*)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (*°F*)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (*°F*)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K (*1/°F*)	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K (*1/°F*)	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K (*1/°F*)	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K (*1/°F*)	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K (*1/°F*)	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K (*1/°F*)	5.4 · 10-6 *(3.0 · 10-6)*
α for quartz	1/K (*1/°F*)	0.5 · 10-6 *(0.3 · 10-6)*
Tolerance of temperature	1/K (*1/°F*)	± 0.3 · 10-6 ± *(0.17 · 10-6)*

response Temperature response with matching in the range of 3)	°C (°F)	-10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 300 µm/m (*microstrain*) - εm Δ 100 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.6 6/120LY11 - Strain Gauges

Specification for 6/120LY11 Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	6
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1.5	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε ≈ ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 100 µm/m *(microstrain)* - εm Δ 80 µm/m *(microstrain)*	 	 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.7 1-XY41-3/120

Specification for 1-XY41-3/120 Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	3
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm ≤ 30 µm/m (*microstrain*) - εm ≥ 30 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.8 1-XY41-6/120

Specification for 1-XY41-6/120 Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	6
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 4x8)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1.5	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 100 µm/m (*microstrain*) - εm Δ 30 µm/m (*microstrain*)	 	 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.9 1-XY91-6/120

Specification for 1-XY91-6/120 Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	6
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1.5	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 30 µm/m (*microstrain*) - εm Δ 30 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.10 1-XY91-3/120

Specification for1-XY91-3/120 Strain Gauges		
SG construction		Foil SG with embedded measuring grid
Measuring grid - Grid Length - Material - Thickness	 mm µm *(microinch)*	 3 Constantan foil 3.8 or 5 *(150 or 197)*, depending on SG type
Carrier - Material - Thickness	 µm *(microinch)*	 Polyimide 45 ± 10 *(1.772 ± 394)*
Covering agent - Material - Thickness	 µm *(microinch)*	 Polyimide 25 ± 12 *(984 ± 472)*
Connections - length without connection leads		Nickel plated Cu leads, approx. 30 mm in Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance Resistance tolerance2) Gage factor Nominal value of gage factor Gage factor tolerance - with 1.5 mm *(0.059 inch)* measuring grid length % - with 3 mm *(0.118 inch)* measuring grid length Temperature coefficient of the gage factor Nominal value of gage factor temperature	Ω % ± 1.5 % 1/K *(1/°F)*	120 ± 0.3 without; ± 0.35 with connection leads approx. 2 Specified on each package ± 1 approx. (90 to 115 ± 10) · (10-6 / °C) coefficient Specified on each package
Reference temperature Operating temperature range - for static, i.e. zero point-related measurements - for dynamic, i.e. non-zero point-related measurements	°C (°F) °C (°F) °C (°F)	23 *(73.4)* - 70 ... + 200 *(-94...+392)* - 200 ... + 200 *(-328...+392)*
Transverse sensitivity - at reference temperature when using Z70 adhesive - on SG type LY11-6/120	 %	Specified on each package - 0.1
Temperature response Temperature response as required, adapted to coefficients of thermal expansion α for ferritic steel α for aluminum α for plastic material α for austenitic steel α for titanium α for molybdenum	 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)* 1/K *(1/°F)*	Specified on each package 10.8 · 10-6 *(6.0 · 10-6)* 23 · 10-6 *(12.8 · 10-6)* 65 · 10-6 *(36.1 · 10-6)* 16 · 10-6 *(8.9 · 10-6)* 9 · 10-6 *(5.0 · 10-6)* 5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 30 µm/m (*microstrain*) - εm Δ 30 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.11 K-LY41-10/120

Specification for K LY41 10/120 Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	10
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1.5	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (*°F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 30 µm/m (*microstrain*) - εm Δ 30 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.12 K-LY41-3/120-3-1M – Wired

Specification for K-LY41-3/120-M-1M Wired Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	3
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Wired (approx. 1000mm long wires connected)
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm (*0.059 inch*) measuring grid length %	± 1.5	
- with 3 mm (*0.118 inch*) measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K (1/°F)	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K (1/°F)	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K (1/°F)	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K (1/°F)	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K (1/°F)	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K (1/°F)	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K (1/°F)	5.4 · 10-6 *(3.0 · 10-6)*
α for quartz	1/K (1/°F)	0.5 · 10-6 *(0.3 · 10-6)*
Tolerance of temperature response	1/K (1/°F)	± 0.3 · 10-6 ± *(0.17 · 10-6)*
Temperature response with	°C (°F)	-10 ... + 20 *(14 ..248)*

matching in the range of 3)		
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120		
at 1st load cycle and adhesive Z 70	µm/m (*microstrain*)	1
at 3rd load cycle and adhesive Z 70	µm/m (*microstrain*)	0.5
at 1st load cycle and adhesive X 60	µm/m (*microstrain*)	2.5
at 3rd load cycle and adhesive X 60	µm/m (*microstrain*)	1
at 1st load cycle and adhesive EP 250	µm/m (*microstrain*)	1
at 3rd load cycle and adhesive EP 250	µm/m (*microstrain*)	1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120		
Absolute strain value ε for positive direction	µm/m (*microstrain*)	50- 000 (5 %)
Absolute strain valueε for negative direction	µm/m (*microstrain*)	50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120		
Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift		
- εm Δ 300 µm/m (*microstrain*)		>> 107 (test was interrupted at 107)
- εm Δ 30 µm/m (*microstrain*)		> 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs	mm (*inch*)	0.3 *(0.012)*
- within measuring grid area	mm (*inch*)	0.3 *(0.012)*
- within solder tabs area	mm (*inch*)	2 *(0.079)*
Bonding material than can be used		
- Cold-curing adhesives		- Z 70; X 60; X 280
- Hot-curing adhesives		- EP 150; EP 250; EP 310S

4.13 K-LY41-6/120-3-1M – Wired

Specification for K-LY41-6/120-3-M Wired Strain Gauges		
SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	6
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Wired (approx. 1000mm long wires connected)
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.35 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm (*0.059 inch*) measuring grid length %	± 1.5	
- with 3 mm (*0.118 inch*) measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K (*1/°F*)	approx. (90 to 115 ± 10) · (10-6 / *°C)*
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (*°F*)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (*°F*)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (*°F*)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K (*1/°F*)	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K (*1/°F*)	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K (*1/°F*)	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K (*1/°F*)	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K (*1/°F*)	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K (*1/°F*)	5.4 · 10-6 *(3.0 · 10-6)*
α for quartz	1/K (*1/°F*)	0.5 · 10-6 *(0.3 · 10-6)*
Tolerance of temperature response	1/K (*1/°F*)	± 0.3 · 10-6 ± *(0.17 · 10-6)*

Temperature response with matching in the range of 3)	°C (°F)	-10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 300 µm/m (*microstrain*) - εm Δ 200 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.14 1-VA61K2.5/350 E

Specification for 1- VA61K2.5/350 E Strain Gauges

SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	1.5
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Nickel plated Cu leads, approx. 30 mm in
- length without connection leads		Integrated solder tabs, approx. 1.5 mm long, approx. 1.6 ... 2.2 mm *(0.063 ± 0.087 inch)* wide
Nominal resistance	Ω	350
Resistance tolerance2)	%	± 0.3 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm *(0.059 inch)* measuring grid length %	± 1.5	
- with 3 mm *(0.118 inch)* measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K *(1/°F)*	approx. (90 to 115 ± 10) · (10-6 / °C)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (°F)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (°F)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (°F)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K *(1/°F)*	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K *(1/°F)*	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K *(1/°F)*	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K *(1/°F)*	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K *(1/°F)*	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K *(1/°F)*	5.4 · 10-6 *(3.0 · 10-6)*

α for quartz Tolerance of temperature response Temperature response with matching in the range of 3)	1/K (*1/°F*) 1/K (*1/°F*) °C (°*F*)	0.5 · 10-6 *(0.3 · 10-6)* ± 0.3 · 10-6 ± *(0.17 · 10-6)* -10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm ≤ 30 µm/m (*microstrain*) - εm ≤ 30 µm/m (*microstrain*)	 	 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.15 1-XY91-6/120 – Wired

Specification 1-XY91-6/120 Wired Strain Gauges		
SG construction		Foil SG with embedded measuring grid
Measuring grid		
- Grid Length	mm	6
- Material		Constantan foil
- Thickness	µm *(microinch)*	3.8 or 5 *(150 or 197)*, depending on SG type
Carrier		
- Material	µm *(microinch)*	Polyimide
- Thickness		45 ± 10 *(1.772 ± 394)*
Covering agent		
- Material	µm *(microinch)*	Polyimide
- Thickness		25 ± 12 *(984 ± 472)*
Connections		Wired (approx. 1000mm long wires connected)
Nominal resistance	Ω	120
Resistance tolerance2)	%	± 0.35 without; ± 0.35 with connection leads
Gage factor		approx. 2
Nominal value of gage factor		Specified on each package
Gage factor tolerance		
- with 1.5 mm (*0.059 inch*) measuring grid length %	± 1.5	
- with 3 mm (*0.118 inch*) measuring grid length	%	± 1
Temperature coefficient of the gage factor	1/K (*1/°F*)	approx. (90 to 115 ± 10) · (10-6 / *°C*)
Nominal value of gage factor temperature		coefficient Specified on each package
Reference temperature	°C (*°F*)	23 *(73.4)*
Operating temperature range		
- for static, i.e. zero point-related measurements	°C (*°F*)	- 70 ... + 200 *(-94...+392)*
- for dynamic, i.e. non-zero point-related measurements	°C (*°F*)	- 200 ... + 200 *(-328...+392)*
Transverse sensitivity		Specified on each package
- at reference temperature when using Z70 adhesive	%	- 0.1
- on SG type LY11-6/120		
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K (*1/°F*)	10.8 · 10-6 *(6.0 · 10-6)*
α for aluminum	1/K (*1/°F*)	23 · 10-6 *(12.8 · 10-6)*
α for plastic material	1/K (*1/°F*)	65 · 10-6 *(36.1 · 10-6)*
α for austenitic steel	1/K (*1/°F*)	16 · 10-6 *(8.9 · 10-6)*
α for titanium	1/K (*1/°F*)	9 · 10-6 *(5.0 · 10-6)*
α for molybdenum	1/K (*1/°F*)	5.4 · 10-6 *(3.0 · 10-6)*
α for quartz	1/K (*1/°F*)	0.5 · 10-6 *(0.3 · 10-6)*
Tolerance of temperature response	1/K (*1/°F*)	± 0.3 · 10-6 ± *(0.17 · 10-6)*

Temperature response with matching in the range of 3)	°C (°F)	-10 ... + 20 *(14 ..248)*
Mechanical hysteresis1) - at reference temperature and strain ε = ± 1000 µm/m (*microstrain*) - on SG type LY11-6/120 at 1st load cycle and adhesive Z 70 at 3rd load cycle and adhesive Z 70 at 1st load cycle and adhesive X 60 at 3rd load cycle and adhesive X 60 at 1st load cycle and adhesive EP 250 at 3rd load cycle and adhesive EP 250	 µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*) µm/m (*microstrain*)	 1 0.5 2.5 1 1 1
Maximum elongation1) - at reference temperature using adhesive Z 70 - on SG type LY11-6/120 Absolute strain value ε for positive direction Absolute strain valueε for negative direction	 µm/m (*microstrain*) µm/m (*microstrain*)	 50- 000 (5 %) 50- 000 (5 %)
Fatigue life1) - at reference temperature using adhesive X 60 - on SG type LY61-6/120 Achievable number of load cycles Lw at alternating strain εw = ± 1000 µm/m and zero point drift - εm Δ 300 µm/m (*microstrain*) - εm Δ 50 µm/m (*microstrain*)		 >> 107 (test was interrupted at 107) > 107 (test was interrupted at 107)
Minimum radius of curvature, longitudinal and transverse, at reference temperature for strain gages with leads for SG with integrated solder tabs - within measuring grid area - within solder tabs area Bonding material than can be used - Cold-curing adhesives - Hot-curing adhesives	mm (*inch*) mm (*inch*) mm (*inch*)	0.3 *(0.012)* 0.3 *(0.012)* 2 *(0.079)* - Z 70; X 60; X 280 - EP 150; EP 250; EP 310S

4.16 Flux Pens (5 pcs)

Introduction

Name: FS 01
Application: Flux

The flux pen is a valuable accessory for very fine soft soldering. It is shaped like a felt tip pen and contains a special non-corrosive flux, based on colophony, which does not spray and conforms with EN 29454; 1.1.3 (F-SW 32 of DIN 8511).

Composition/information on ingredients

Chemical characterization

Description: Mixture consisting of the following components.

Dangerous components:

CAS: 67-63-0	propan-2-ol	Xi, F; R 11-36-67	50-100%
EINECS: 200-661-7			
CAS: 8050-09-7	Balsamharz	Xi; R 43	10-25%
EINECS: 232-475-7			
CAS: 124-04-9	adipic acid	Xi; R 36	2.5-10%
EINECS: 204-673-3			

. Regulation (EC) No 648/2004 on detergents, Labelling for contents

Lösungsmittel ≥ 30%

Physical and chemical properties:

General Information

Form:	Fluid
Colour:	Ember coloured
Smell:	Alcohol-like
Change in condition	
Melting point/Melting range:	Not determined
Boiling point/Boiling range:	82°C
Flash point:	13°C
Ignition temperature:	425°C
Self-inflammability:	Product is not selfigniting.
Danger of explosion:	Product is not explosive. However, formation of explosive air/steam mixtures is possible.
Critical values for explosion:	
Lower:	2.0 Vol %
Upper:	12.0 Vol %
Steam pressure at 20°C:	48 hPa
Density at 20°C	0.833 g/cm³
Solubility in / Miscibility with	
Water:	Partly miscible