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Data Sheet

Customer:	
Product :	Automotive Grade Professional Thin Film Chip Resistor- HART Series
Size:	0402/0603/0805/1206
Issued Date:	25-Apr-22
Edition :	REV.A

Record of change

Date	Ver.	Description	Page

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HART series.

Automotive Grade Professional Thin Film Chip Resistor



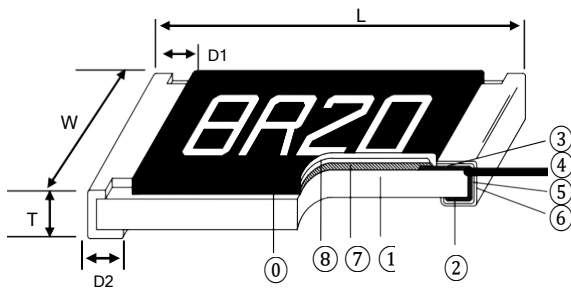
■ Features

- Operating temperature up to 175°C for 1000 h
- Rated dissipation P_{85} up to 0.4W for size 1206
- AEC-Q200 Compliance
- Superior temperature cycling robustness
- Advanced sulfur resistance verified according to ASTM B 809

■ Applications

- Automotive
- Telecommunication
- Medical equipment
- Industrial equipment

■ Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑩ Marking

■ Dimensions

Unit: mm

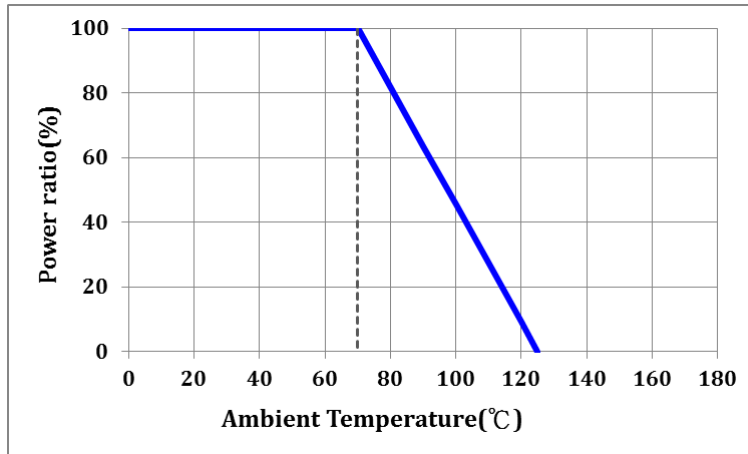
Type	Size (Inch)	L	W	T	D1	D2	Weight(g) (1000pcs)
HART02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10	0.54
HART03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.83
HART05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20	4.71
HART06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	9.02

■ Part Numbering

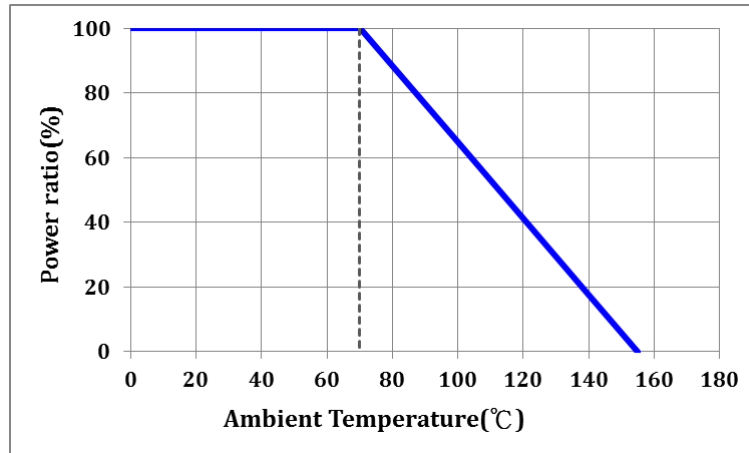
HART	03	F	T	C	-	1001	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206	B: ±0.1% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	- : Standard	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1002: 10 KΩ 1003: 100KΩ 1004: 1M Ω	A: Automotive Grade

**** If you have any request not find from above datas, please contact our sales for further information, we may do our best to meet your request.**

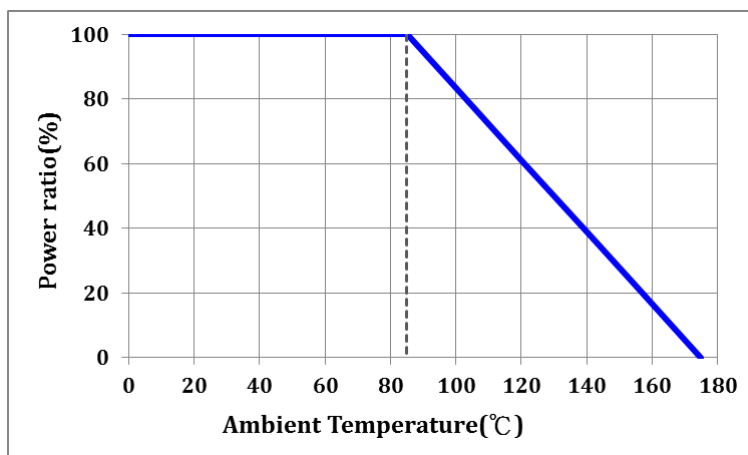
■ **Functional Performance**
 Derating-Standard Operation



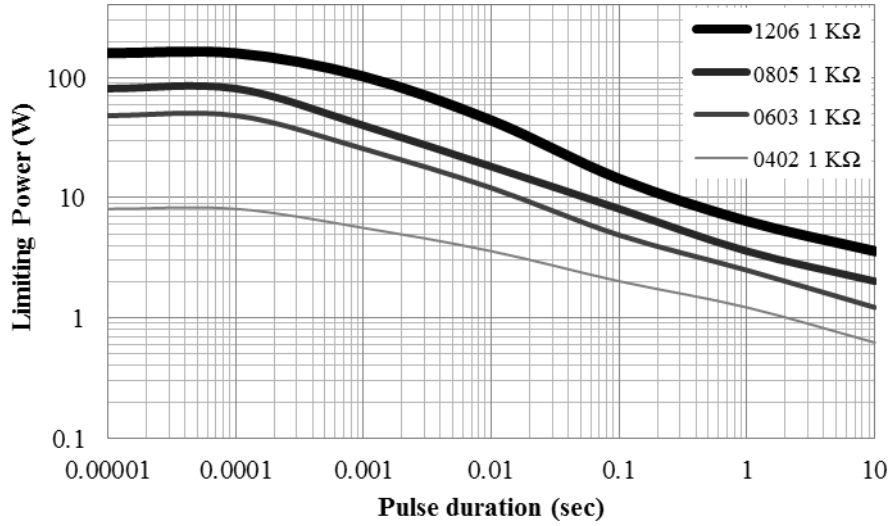
Derating- Power Operation



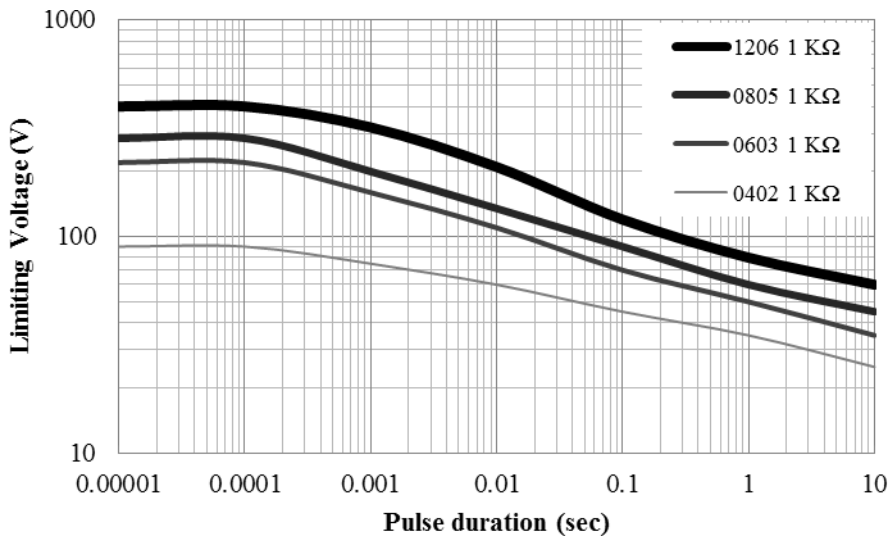
Derating- Advanced Power Operation



■ **Functional Performance**
Single pulse



Pulse Voltage



■ Standard Electrical Specifications

Type	Item Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.5%	±1%	
HART02	1/10W	-55 ~ +175°C	50V	100V	49.9Ω - 221KΩ			±25,±50
HART03	3/20W	-55 ~ +175°C	75V	150V	10Ω - 511KΩ			±25,±50
HART05	1/5W	55 ~ +175°C	150V	300V	10Ω - 1MΩ			±25,±50
HART06	2/5W	-55 ~ +175°C	200V	400V	10Ω - 1MΩ			±25,±50

■ Maximum Resistance Change at Rated Dissipation

Operation Mode		Standard P ₇₀	Power P ₇₀	Advanced Temperature P ₈₅
Rated dissipation	HART02	0.063W	0.100W	0.100W
	HART03	0.100W	0.125W	0.150W
	HART05	0.125W	0.200W	0.200W
	HART06	0.250W	0.400W	0.400W
Operating temperature range		-55 ~ 125°C	-55 ~ 155°C	-55 ~ 175°C
Permissible film temperature		125°C	155°C	175°C
Max. resistance change at rated dissipation for resistance range, ΔR/R after:	HART02	49.9Ω - 221KΩ	49.9Ω - 221KΩ	49.9Ω - 221KΩ
	HART03	10Ω - 511KΩ	10Ω - 511KΩ	10Ω - 511KΩ
	HART05	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ
	HART06	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ
	1000hr	≅ 0.15%	≅ 0.3%	≅ 0.5%
	8000hr	≅ 0.25%	≅ 0.5%	—

Operating Voltage=√(P*R) or Max. operating voltage listed above, whichever is lower.

Overload Voltage=2.5*√(P*R) or Max. overload voltage listed above, whichever is lower.

▪ Viking is capable of manufacturing the optional spec based on customer's requirement.

Item	Requirement		Test Method	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		MIL-STD-202 Method 304 +25/-55/+25/+125/+25°C	
Short Time Overload (Standard operation mode)	$\Delta R \pm 0.10\%$		JIS-C-5201-1 4.13 RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds	
Short Time Overload (Power operation mode)	$\Delta R \pm 0.25\%$			
Insulation Resistance	>1000 M Ω		MIL-STD-202 Method 302 Apply 100V _{DC} for 1 minute	
Endurance	Standard at 70°C	1000hrs	$\Delta R \pm 0.15\%$	MIL-STD-202 Method 108 RCWV with 1.5 hrs "ON" and 0.5 hrs "OFF"
		8000hrs	$\Delta R \pm 0.25\%$	
	Power at 70°C	1000hrs	$\Delta R \pm 0.3\%$	
		8000hrs	$\Delta R \pm 0.5\%$	
Advanced temperature at 85°C	1000hrs	$\Delta R \pm 0.5\%$		
High Temperature Exposure	125°C	$\Delta R \pm 0.15\%$	EN 60115-1 CLAUSE 4.25.3 1000 hrs	
	155°C	$\Delta R \pm 0.3\%$		
	175°C	$\Delta R \pm 0.5\%$		
Temperature Cycling	$\Delta R \pm 0.25\%$		JESD22 Method JA-104 -55°C to +155°C, 1000 cycles	
Biased Humidity	Standard operation mode $\Delta R \pm 0.5\%$		MIL-STD-202 Method 103 1000hrs 85°C/85%RH 10% of operating power (≤ 100 V)	
Bending Strength (Board Flex)	$\Delta R \pm 0.1\%$		JIS-C-5201-1 4.33 Bending once for 60 seconds Bending displacement: 0402 0603 0805 1206 sizes: 3 mm	
Solderability	95% min. coverage		JIS-C-5201-1 4.17 IEC-60115-1 4.17 245 \pm 5°C for 3 seconds	
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$		JIS-C-5201-1 4.18 IEC-60115-1 4.18 260 \pm 5°C for 10 seconds	
Terminal strength	No broken		AEC-Q200-006 0402 0603: Force of 1kg for 60 seconds. Others: Force of 1.8kg for 60 seconds.	
Mechanical Shock	$\Delta R \pm 0.1\%$		MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.	
Vibration	$\Delta R \pm 0.1\%$		MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz	
ESD	$\Delta R \pm 0.5\%$		AEC-Q200-002 Human body model 0402 0.2 KV; 0603 0.5 KV; 0805 1.5 KV; 1206 2.0 KV	
Resistance to solvents	Marking Unsmearred		MIL-STD-202 Method 215 Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.	
Flammability	No ignition of the tissue paper or scorching or the pinewood board		UL-94 V-0 or V-1 are acceptable. Electrical test not required.	
External Visual	No visible damage.		MIL-STD-883 Method 2009 Electrical test not required. Inspect device construction, marking and workmanship.	

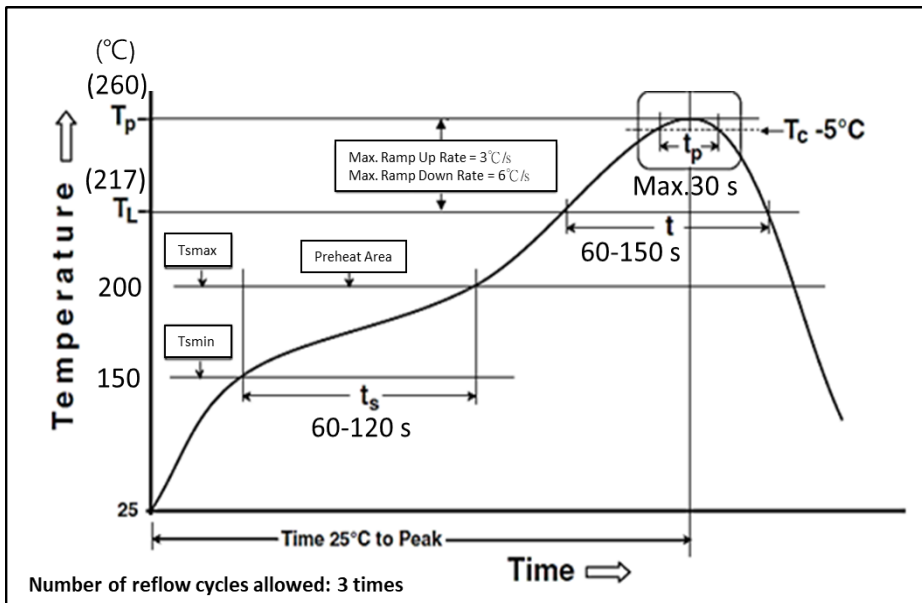
Physical Dimension	As Spec.	JESD22 Method JB-100 Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers Specification. Electrical test not required.
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RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date.

■ Soldering Condition(IPC/JEDEC J-STD-020)



HART series.

Automotive Grade Professional Thin Film Chip Resistor

■ Marking

0603 3digit marking



3digit marking for Example: 14C=13K7Ω 13C=13K3Ω

68B=4K99Ω 68X=49.9Ω

0603 3digit marking for E24

Example: 101=100Ω 102=1KΩ

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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0805~1206 4digit marking

Example

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
marking	1000	2201	1002	4992	1003

Marking Table

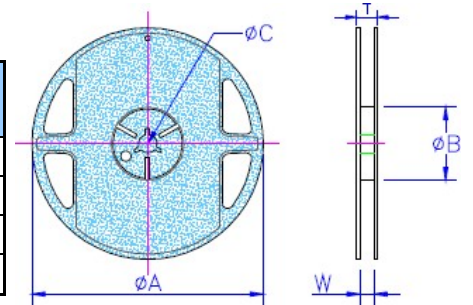
Code	E96	Code	E96	Code	E96	Code	E96				
01	100	25	178	49	316	73	562				
02	102	26	182	50	324	74	576				
03	105	27	187	51	332	75	590				
04	107	28	191	52	340	76	604				
05	110	29	196	53	348	77	619				
06	113	30	200	54	357	78	634				
07	115	31	205	55	365	79	649				
08	118	32	210	56	374	80	665				
09	121	33	215	57	383	81	681				
10	124	34	221	58	392	82	698				
11	127	35	226	59	402	83	715				
12	130	36	232	60	412	84	732				
13	133	37	237	61	422	85	750				
14	137	38	243	62	432	86	768				
15	140	39	249	63	442	87	787				
16	143	40	255	64	453	88	806				
17	147	41	261	65	464	89	825				
18	150	42	267	66	475	90	845				
19	154	43	274	67	487	91	866				
20	158	44	280	68	499	92	887				
21	162	45	287	69	511	93	909				
22	165	46	294	70	523	94	931				
23	169	47	301	71	536	95	953				
24	174	48	309	72	549	96	976				
Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

■ Packaging

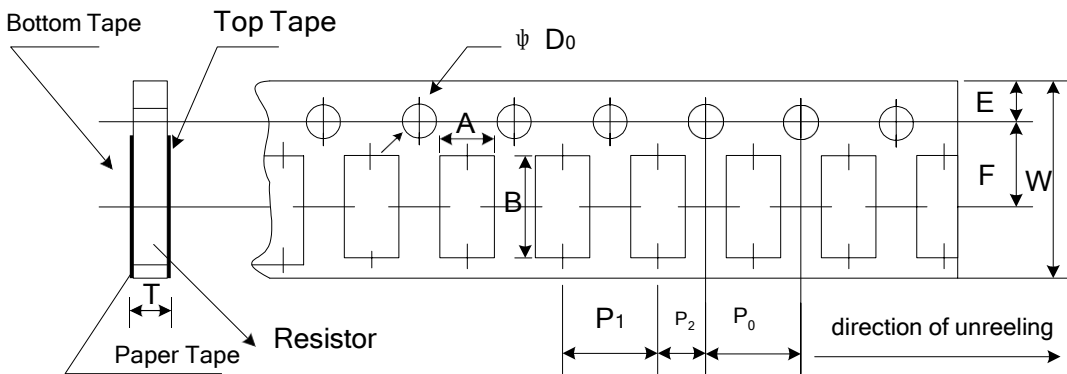
Packing Quantity & Reel Specifications

Unit : mm

Type	∅ A	∅ B	∅ C	W	T	Paper Tape (EA)	EmbossPlastic Tape (EA)
HART02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
HART03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
HART05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
HART06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-



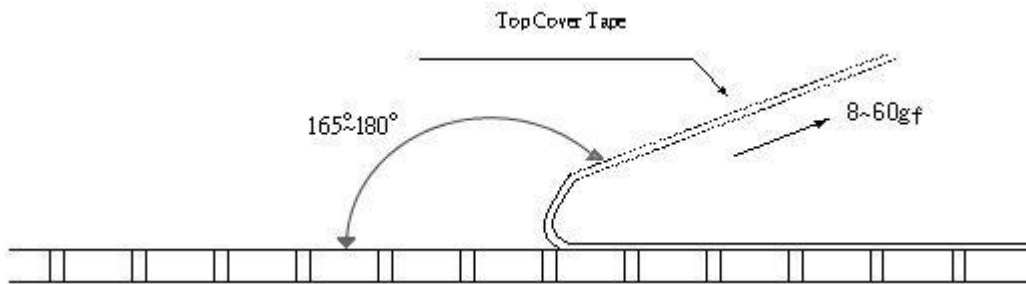
Paper Tape Specifications



Unit: mm

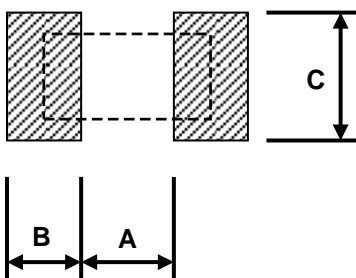
Type	A	B	W	E	F	P ₀	P ₁	P ₂	∅D ₀	T
HART02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
HART03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
HART05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
HART06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.75±0.05

- Peel force of top cover tape
- The peel speed shall be about 300mm/min±5%
- The peel force of top cover tape shall be between 8gf to 60gf



■ Recommend Land Pattern

Unit: mm



Type	A	B	C
HART02	0.50	0.50	0.60±0.2
HART03	0.80	1.00	0.90±0.2
HART05	1.00	1.00	1.35±0.2
HART06	2.00	1.15	1.70±0.2



HART series.

Automotive Grade Professional Thin Film Chip Resistor

■ Safety Precautions

- Install the following fail-safe design systems to ensure safety. If these products are used in equipment, the defects of these products may cause casualties or other severe damage, such as damage to vehicles (cars, trains, ships), traffic lights, medical equipment, aviation Aerospace equipment, electric heating equipment, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
 - ★ The system is equipped with protection circuits and protection devices.
 - ★ The system is equipped with redundant circuits or other systems to prevent an unsafe state in the event of a single failure.
 - ★ The system is equipped with a system to prevent the spread of fire or prevent malfunctions.
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