

Anti-scratch agent

NOF[®]-ALLOY KA832

1 Introduction

NOF[®]-ALLOY KA832 is the novel type anti-scratch improver which is exclusively manufactured by NOF CORPORATION based on unique NOF's radical grafting technology. It has the following characteristics.

- NOF[®]-ALLOY KA832 can improve both the anti-scratch and the anti-mar properties of PP compound, PC / ABS, PC, ASA, PMMA, TPO, and rubber, etc.
- NOF[®]-ALLOY KA832 can reduce the risk of the squeak noise generated when it is rubbed with leather by adding into PP compound.



Fig 1. NOF[®]-ALLOY KA832

NOF[®]-ALLOY KA832 can be used as an anti-scratch agent as well as anti-squeak agent for automotive exterior and interior parts.

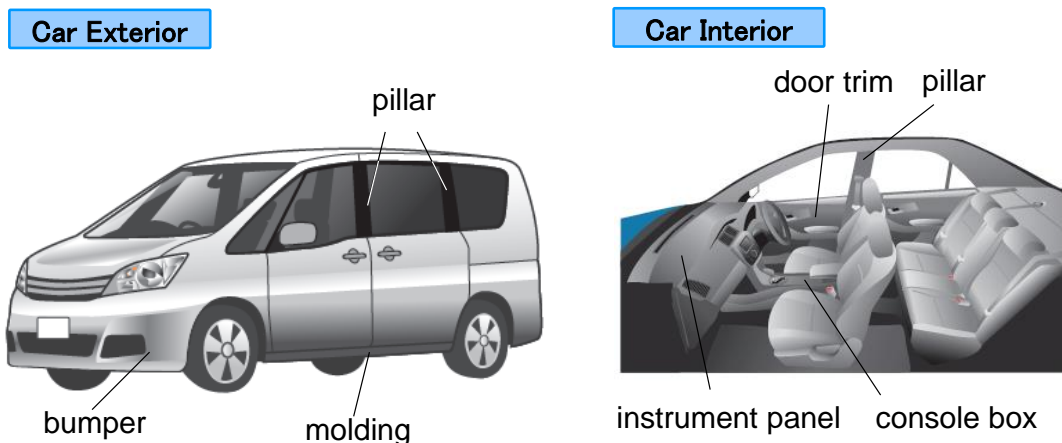


Fig 2. Target application of NOF[®]-ALLOY KA832

2 Basic properties of NOF[®]-ALLOY KA832

Table 1. Basic properties of NOF[®]-ALLOY KA832

	Appearance	Mechanical property	Thermal properties		
		MFR ¹⁾ g/10min	TGA ²⁾		DSC ³⁾
			1% weight loss temp. °C	5% weight loss temp. °C	Melting point °C
NOF[®]-ALLOY KA832	Translucent white pellet	20	230	270	83

1) ISO 1133(JIS K 7210)、190°Cx2.16 kgf

2) JIS K 7120、Thermo Gravimetric Analysis (Rate of temperature rise : 10 °C/min, N₂ atmosphere)

3) JIS K 7121、Differential Scanning Calorimetry (Rate of temperature rise : 10 °C/min, N₂ atmosphere)

3 Applicable resins and usage of NOF[®]-ALLOY KA832

Table 2. Applicable resins of NOF[®]-ALLOY KA832

	PP compound ¹⁾	ASA	PMMA	TPO	cross-linked EPDM	cross-linked NBR
NOF[®]-ALLOY KA832	√+	√	√	√+	√	√

√+ : Especially highly effective、√ : highly effective (details are shown on p.3)

1) PP compound.....(ex.) b-PP/EPR/Talc = 70/10/20 wt.%

Table 3. Blending method of resins with NOF[®]-ALLOY KA832

blending method	resin	condition
Twin screw extruder	PP compound, TPO	(Cylinder) 190~220°C
	ASA, PMMA	(Cylinder) 240~250°C
Bunbury mixer	cross-linked EPDM, NBR	(Can body) 180°C
Roll		(Kneading time) 3 min.

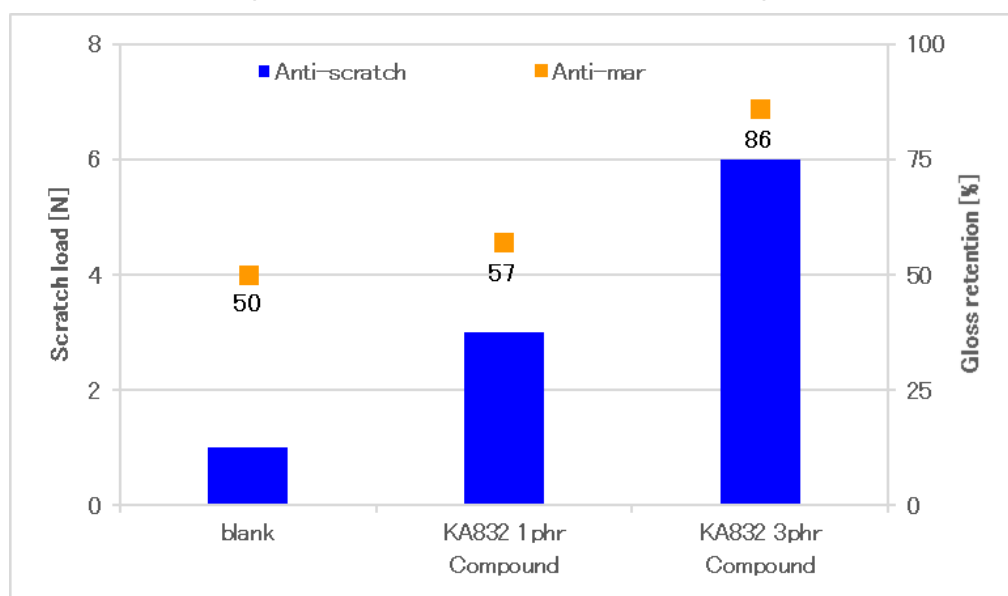
Table 4. Molding condition of resins with NOF[®]-ALLOY KA832

molding method	resin	condition
Injection molding	PP compound	(Cylinder) 190~220°C (Molding) 50°C
	ASA, PMMA	(Cylinder) 240~250°C (Molding) 80°C
Extrusion molding	TPO	(Cylinder) 190~220°C (Molding) 50°C
Press molding	cross-linked EPDM, NBR	(Press) 180°C, 20 min.

PP..... Polypropylene
 ASA..... Acrylate-Styrene-Acrylonitrile
 PMMA..... Polymethyl methacrylate
 TPO..... Thermoplastic elastomer olefin
 EPDM..... Ethylene propylene diene rubber
 NBR..... Nitril-butadiene rubber

4 Anti-scratch property of NOF[®]-ALLOY KA832 for PP compounds

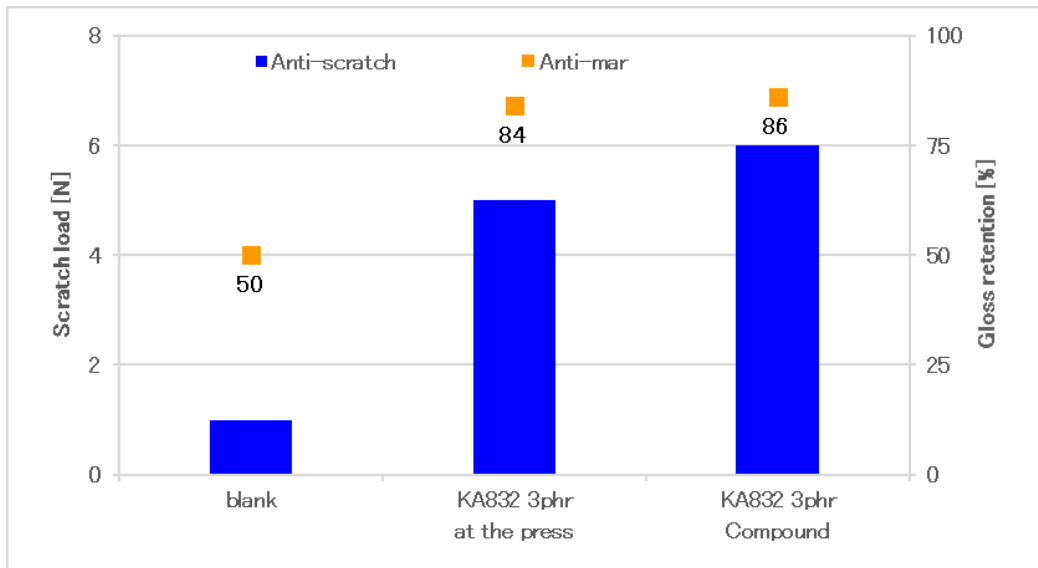
NOF[®]-ALLOY KA832 can improve the scratch resistance of PP compounds.



* [sample preparation]: NOF[®]-ALLOY KA832 and PP are compounded before molding specimens

Fig 3. Scratch resistance of PP compounds added NOF[®]-ALLOY KA832 at compounding step

In addition, **NOF[®]-ALLOY KA832** can improve scratch resistance of PP compounds even adding at the press (molding step).



* [sample preparation]: **NOF[®]-ALLOY KA832** is added into PP at the press.

Fig 4. Scratch resistance of PP compounds added **NOF[®]-ALLOY KA832** at the press

5 Anti-mar resistance of **NOF[®]-ALLOY KA832** for rubbers

NOF[®]-ALLOY KA832 can improve the mar resistance of TPO as well as cross-linked rubbers.

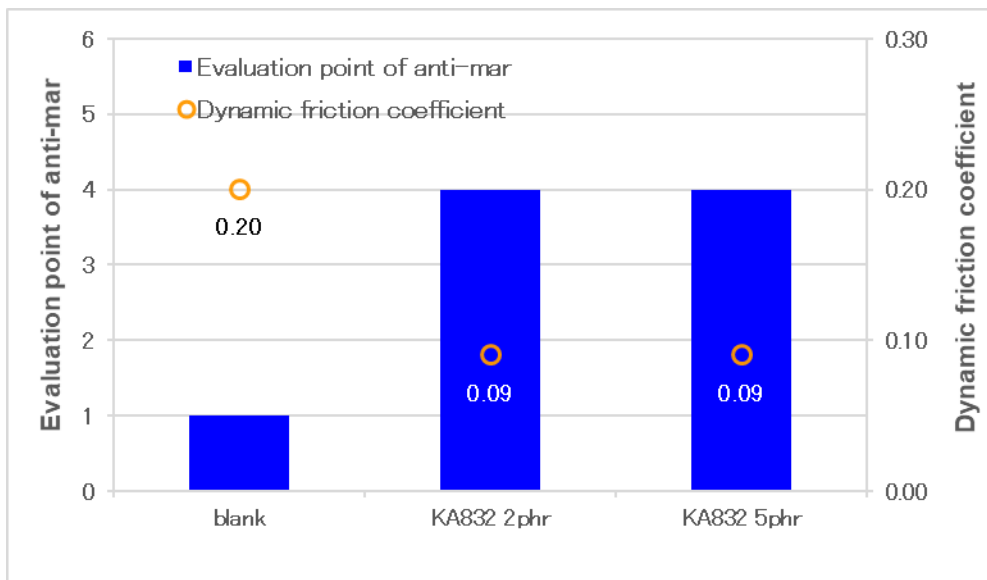
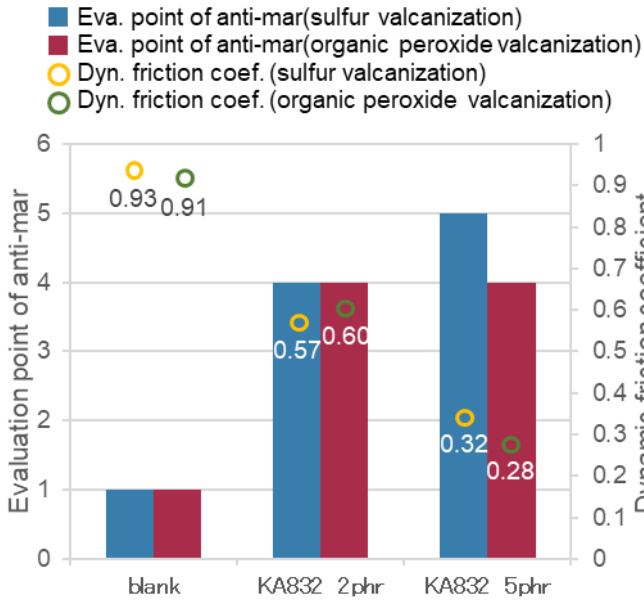
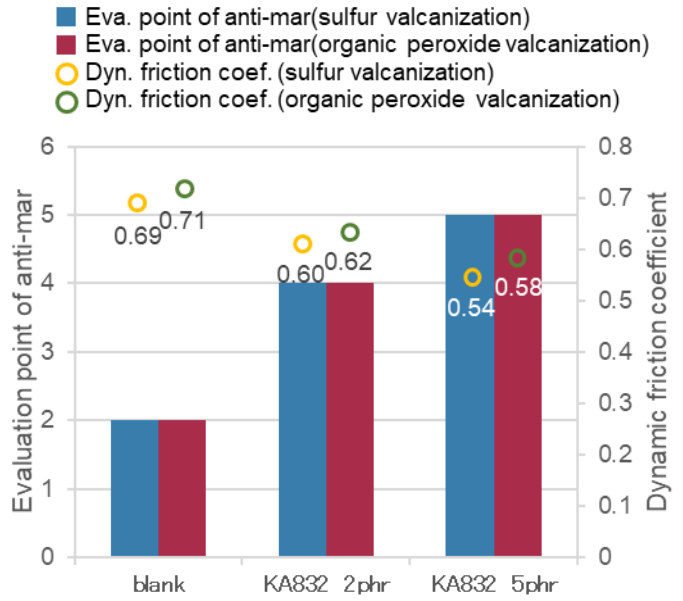


Fig 5. Mar resistance of TPO along with **NOF[®]-ALLOY KA832**



【sample composition (sulfur valcanization)】
 NBR/NOF[®]-ALLOY KA832/crosslinking agent=100/0-5/0.5
【sample composition (organic peroxide valcanization)】:
 NBR/ NOF[®]-ALLOY KA832/ crosslinking agent =100/0-5/2.2
 * organic peroxide: Percumyl[®]D

Fig 6. Mar resistance of cross-linked NBR along with NOF[®]-ALLOY KA832



【sample composition (sulfur valcanization)】
 EPDM/NOF[®]-ALLOY KA832/ crosslinking agent =100/0-5/0.5
【sample composition (organic peroxide valcanization)】:
 EPDM/ NOF[®]-ALLOY KA832/ crosslinking agent =100/0-5/2.7
 * organic peroxide: Percumyl[®]D

Fig 7. Mar resistance of cross-linked EPDM along with NOF[®]-ALLOY KA832

6 Anti-squeak property of NOF[®]-ALLOY KA832

NOF[®]-ALLOY KA832 can prevent squeak noise between PP compound and leather.

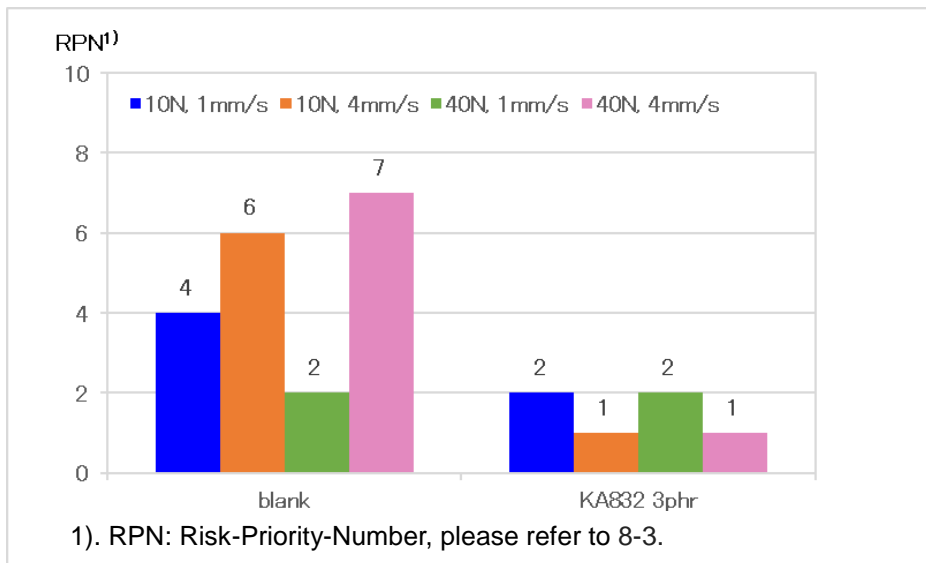


Fig 8. Anti-squeak property of NOF[®]-ALLOY KA832

7 Mechanical properties of each resin containing NOF[®]-ALLOY KA832

The mechanical properties of each material containing **NOF[®]-ALLOY KA832** are shown in Table 5-6.

Table 5. Mechanical properties of each resin containing with NOF[®]-ALLOY KA832

Resin	KA832 phr	Tensile strength	Flexural modulus	Izod impact	HDT
		MPa	MPa	kJ/m ²	°C
PP compound	0	21	1,900	5	-
	3	20	1,700	8	-
ASA	0	44	2,100	22	-
	3	40	2,000	23	-
PMMA	0	75	3,100	1	83
	3	76	2,900	1	79
	5	71	2,900	1	78

Table 6. Mechanical properties of TPO and cross-linked EPDM with NOF[®]-ALLOY KA832

Resin	KA832 phr	Tensile		Hardness	Compression set	
		Strength MPa	Elongation %	Shore A -	23°C %	120°C %
TPO	0	10	590	A 87	26	91
	2	10	630	A 86	30	81
	5	11	630	A 84	27	101
Cross-linked EPDM	0	16	180	A 65	5	6
	2	16	220	A 64	7	6
	5	15	220	A 64	8	8

8 Evaluation Method

8-1. Evaluation of Anti-scratch property

- ◆ Test equipment
Scratch tester KK-01 (KATO TECH Co., Ltd.)
- ◆ Evaluation condition
ISO 19252(ASTM D7027-05)
Incremental load..... 1 – 15 N or 1 – 30 N
Scratch velocity 100 mm/s
Scratch distance..... 100 mm
Tip size φ=1.0 mm (Stainless steel ball)
- ◆ Evaluation

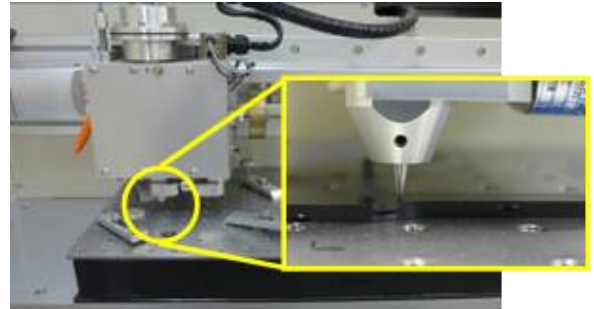


Fig 9. Scratch tester KK-01

The value of anti-scratch property is shown as the load that the initial scratch mark was observed on surface. It is prefer that scratch load is large.



Fig 10. Evaluation of anti-scratch property

8-2. Evaluation of Anti-mar property (Evaluation of mar test by cloth)

- ◆ Test equipment
NO416-TMI CROCK METER (YASUDA SEIKI SEISAKUSHO, LTD.)
- ◆ Evaluation condition
Load 1,000 gf (Wear tip area is 2 cm².)
Velocity 200 mm/s
Round 100 times
Counter material..... Cotton cloth
- ◆ Evaluation
Gloss retention is calculated from initial and after tested gloss.
It is prefer that gloss retention is large.
Gloss retention (%) = After tested gloss / Initial gloss

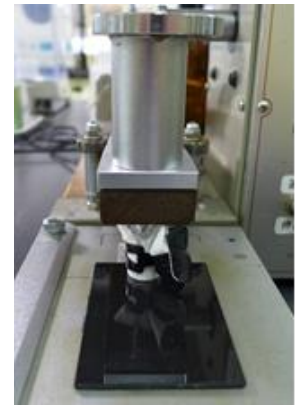


Fig 11. NO416-TMI CROCK METER

Table 7. Evaluation points of anti-mar property

Point	Evaluation result	
1	Attaches mar mark, and remains abrasion powder	<p>poor</p> <p>↕</p> <p>good</p>
2	Mar area is 75% or more and less than 100%	
3	Mar area is 50% or more and less than 75%	
4	Mar area is 25% or more and less than 50%	
5	Mar area is less than 25%	
6	No mar mark	

8-3. Evaluation of squeak noise (Stick-slip test)

◆ Test equipment

STICK-SLIP TEST STAND (ZIEGLER-INSTRUMENTS GmbH)

◆ Evaluation condition (VDA230-206 : German Automobile Industry Association Standard)

Test materialPP compound

Counter material.....Article leather (PVC)

Load10 or 40 N

Velocity1 or 4 mm/s

Amplitude20 mm

Reciprocation times3 times

◆ Evaluation

The two specimens (big and small) are prepared. Big one (Test material) is reciprocated and rubbed with small one by 3 times. The risk of squeak noise is shown by Risk-Priority-Number (RPN) which is ranked by the 10 stages shown below, (In case of RPN=1~3, it is categorized as No stick-slip risk).

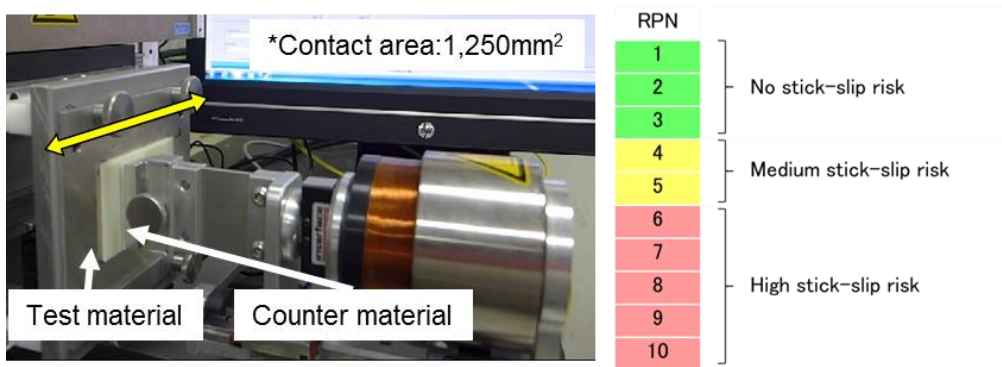


Fig 12. Stick-slip test stand

8-4. Evaluation of dynamic friction coefficient

◆ Test equipment

TriboGear TYPE : 14DR (SHINTO Scientific Co., Ltd.)

◆ Evaluation condition

ASTM D1894

Load 1 kgf

Velocity 600 mm/min

Distance 50 mm

8-5. Evaluation of mechanical properties

Table 8. Evaluation methods and conditions of mechanical properties

evaluation	resin	method / condition
Tensile	PP compound, ASA, PMMA	ISO 527-1, test speed 50 mm/min
	TPO, cross-linked EPDM, cross-linked NBR	ISO 37, test speed 500 mm/min
Flexural modulus	PP compound, ASA, PMMA	ISO 178, test speed 2 mm/min
Izod impact		ISO 180, 23°C, notched
HDT		ISO 75, bending stress 1.8 MPa
Hardness	TPO, cross-linked EPDM, cross-linked NBR	ISO 7619-1, type A durometer
Izod impact		ISO815-1, 23°C or 120°Cx22 h

9 Legal registration of NOF®-ALLOY KA832

Table 9. Legal registration of NOF®-ALLOY KA832¹⁾

Japan	EU	US	China	Korea	Taiwan
ENCS	REACH	TSCA	IECSC	ECL	TCSCA
Polymer exemption	Import available *Constituent monomer: Registered	Import available *Unlisted polymer is declared as polymer exemption	Import available *Unlisted component is confirmed as simplified declaration ²⁾	Import available *Unlisted component is confirmed as registration exemption ³⁾	Import available *Listed (ACTIVE)

1) Please be sure to contact us before imported to each country

2) Confirmed as Low Concern Polymers / Registered by NOF(Shanghai) Co., Ltd.

3) Confirmed as Low Concern Polymers

10 Package

- 20kg in paper bag

11 Notes

- If the NOF®-ALLOY KA series are spilled on the floor, it will be very slippery so please collect immediately and remove it.
- Although the content described in this document is based on materials, information, data etc. that were available at the present time, it is not a guarantee concerning physical properties, chemical properties, hazards etc.
- When using this product, please test and check the legal regulations corresponding to the application and conformity / safety to use.
- For other general matters, please refer to the safety data sheet (SDS).

■ Handling of contents of description

Although the contents of the description are prepared based on the materials, information and data that were available at the moment, we do not make any guarantee as to the written data, evaluation, danger, etc. In addition, since the items described are intended for normal handling, please handle handling in accordance with usage and usage appropriate for usage in special handling.

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2nd Edition Oct. 2023