

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Specifications for particular types of winding wires –
Part 53: Aromatic polyamide (aramid) tape wrapped rectangular copper wire,
temperature index 220

Spécifications pour types particuliers de fils de bobinage –
Partie 53: Fil de section rectangulaire en cuivre enveloppé avec un ruban
polyamide aromatique (aramide), d'indice de température 220



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SPECIFICATIONS FOR PARTICULAR
TYPES OF WINDING WIRES –****Part 53: Aromatic polyamide (aramid) tape wrapped
rectangular copper wire, temperature index 220**

FOREWORD

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International Standard IEC 60317-53 has been prepared by IEC technical committee 55: Winding wires.

This second edition cancels and replaces the first edition published in 1999. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- new 3.2.2 containing general notes on winding wire, formerly a part of the scope;
- new 3.3, containing requirements for appearance;
- modification to Clause 15 to delete the note on revisions to IEC 60172;
- new Clause 23, Pin hole test.

The text of this standard is based on the following documents:

CDV	Report on voting
55/1396/CDV	55/1458/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The numbering of clauses in this standard is not continuous from Clauses 20 and 30 in order to reserve space for possible future wire requirements prior to those for wire packaging.

A list of all parts in the IEC 60317 series, published under the general title *Specifications for particular types of winding wires*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

This part of IEC 60317 is one of a series which deals with insulated wires used for windings in electrical equipment. The series has three groups describing:

- 1) Winding wires – Test methods (IEC 60851);
- 2) Specifications for particular types of winding wires (IEC 60317);
- 3) Packaging of winding wires (IEC 60264).

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SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 53: Aromatic polyamide (aramid) tape wrapped rectangular copper wire, temperature index 220

1 Scope

This part of IEC 60317 specifies requirements for tape wrapped rectangular copper winding wire of temperature index 220. The insulation consists of one or more wrappings of aromatic polyamide (aramid) tape of various thicknesses.

NOTE The heat shock test is inappropriate for this type of wire, and therefore a heat shock temperature cannot be established. Consequently, a class based on the requirements for temperature index and heat shock temperature cannot be specified.

The range of nominal conductor dimensions covered by this standard is:

- width: min. 2,00 mm max. 16,00 mm;
- thickness: min. 0,80 mm max. 5,60 mm.

The specified combinations of width and thickness as well as the specified ratio width/thickness are given in Table 1.

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2 Normative references

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The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60172, *Test procedure for the determination of the temperature index of enamelled winding wires*

IEC 60819-3-3:2011, *Non-cellulosic papers for electrical purposes – Part 3: Specifications for individual materials – Sheet 3: Unfilled aramid (aromatic polyamide) papers*

IEC 60851 (all parts), *Winding wires – Test methods*

3 Terms, definitions, general notes and appearance

3.1 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1.1

class

thermal performance of a wire expressed by the temperature index and the heat shock temperature

3.1.2**conductor**

bare metal after removal of the insulation

3.1.3**covering**

material which is wound, wrapped or braided around a bare or insulated conductor

3.1.4**insulation**

coating or covering on the conductor with the specific function of withstanding voltage

3.1.5**winding wire**

wire used for winding a coil to provide a magnetic field

3.1.6**wire**

conductor coated or covered with an insulation

3.2 General notes**3.2.1 Methods of test**

All methods of test used in this part of IEC 60317 are given in IEC 60851.

The clause numbers used in this standard are identical to the corresponding test numbers in the IEC 60851 series of standards.

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In case of inconsistencies between the publication on methods of test and this standard, IEC 60317-53 shall prevail.

Where no specific range of nominal conductor dimensions is given for a test, the test applies to all nominal conductor dimensions covered by the specification sheet.

Unless otherwise specified, all tests shall be carried out at a temperature from 15 °C to 35 °C and a relative humidity from 45 % to 75 %. Before measurements are made, the specimens shall be preconditioned under these atmospheric conditions for a time sufficient to allow the specimens to reach stability.

The wire to be tested shall be removed from the packaging in such a way that the wire will not be subjected to tension or unnecessary bends. Before each test, sufficient wire should be discarded to ensure that any damaged wire is not included in the test specimens.

3.2.2 Winding wire

One or more tape layers may be applied. Combinations of different types, different thickness and degree of overlap shall be agreed between the purchaser and the supplier.

Where adhesive is used to secure the loose ends of the tape, it shall be compatible with the insulation system in use.

The temperature in degrees Celsius corresponding to the temperature index is not necessarily that at which the wire is recommended to be operated and this will depend on many factors, including the types of equipment involved.

When reference is made to winding wire according to this standard, the following information should be given:

- reference to IEC 60317-53;
- dimensions of the conductor;
- reference should also be made to the number and thickness of the papers used and to the degree of overlap, as agreed between purchaser and supplier.

3.3 Appearance

Before wrapping, the conductor shall be completely free from copper dust and other extraneous matter.

The tape covering shall be essentially smooth and continuous, wrapped around the conductor tightly, evenly and free from creases, wrinkles and foreign material when examined with normal vision, as wound on the original spool or reel.

4 Dimensions

4.1 Conductor dimensions

The dimensions for widths and thicknesses of conductors of winding wires with rectangular cross-section recommended in this standard are taken from the R 20 and R 40 series according to ISO 3.

Preferred sizes are combinations of width and thickness both according to the R 20 series.

Intermediate sizes are combinations of width or thickness according to the R 20 series with the other dimension according to the R 40 series.

This standard covers:

- widths from 2,00 mm up to and including 16,00 mm;
- thicknesses from 0,80 mm up to and including 5,60 mm.*

The ratio width/thickness shall be greater than or equal to 1,4:1 and shall not exceed 8:1.

The actual values of dimensions are given in Table 1.**

The nominal cross-sectional areas for preferred sizes are given in Table 1.

* For thicknesses over 5,60 mm up to and including 10 mm and for widths over 16 mm up to and including 25 mm where, for technical reasons, additional sizes may be needed, the R 40 series shall be used. The ratio width/thickness shall be within the specified limits and combinations of R 20 and R 40 are not allowed in the case of additional sizes.

** Dimensions according to R 20 series are printed in larger type.

Table 1 – Nominal cross-sectional areas of preferred sizes

Width mm	Thickness																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	0,80	0,85	0,90	0,95	1,00	1,06	1,12	1,18	1,25	1,32	1,40	1,50	1,60	1,70	1,80	1,90	2,00	2,12	2,24	2,36	2,50	2,65	2,80	3,00	3,15	3,35	3,55	3,75	4,00	4,25	4,50	4,75	5,00	5,30	5,60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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2,00	1,463	1,626	1,785	1,942	2,100	2,258	2,417	2,576	2,735	2,894	3,053	3,212	3,371	3,530	3,689	3,848	4,007	4,166	4,325	4,484	4,643	4,802	4,961	5,120	5,279	5,438	5,597	5,756	5,915	6,074	6,233	6,392	6,551	6,710	6,869	7,028	7,187	7,346	7,505	7,664	7,823	7,982	8,141	8,300	8,459	8,618	8,777	8,936	9,095	9,254	9,413	9,572	9,731	9,890	10,049	10,208	10,367	10,526	10,685	10,844	11,003	11,162	11,321	11,480	11,639	11,798	11,957	12,116	12,275	12,434	12,593	12,752	12,911	13,070	13,229	13,388	13,547	13,706	13,865	14,024	14,183	14,342	14,501	14,660	14,819	14,978	15,137	15,296	15,455	15,614	15,773	15,932	16,091	16,250	16,409	16,568	16,727	16,886	17,045	17,204	17,363	17,522	17,681	17,840	17,999	18,158	18,317	18,476	18,635	18,794	18,953	19,112	19,271	19,430	19,589	19,748	19,907	20,066	20,225	20,384	20,543	20,702	20,861	21,020	21,179	21,338	21,497	21,656	21,815	21,974	22,133	22,292	22,451	22,610	22,769	22,928	23,087	23,246	23,405	23,564	23,723	23,882	24,041	24,200	24,359	24,518	24,677	24,836	24,995	25,154	25,313	25,472	25,631	25,790	25,949	26,108	26,267	26,426	26,585	26,744	26,903	27,062	27,221	27,380	27,539	27,698	27,857	28,016	28,175	28,334	28,493	28,652	28,811	28,970	29,129	29,288	29,447	29,606	29,765	29,924	30,083	30,242	30,401	30,560	30,719	30,878	31,037	31,196	31,355	31,514	31,673	31,832	31,991	32,150	32,309	32,468	32,627	32,786	32,945	33,104	33,263	33,422	33,581	33,740	33,899	34,058	34,217	34,376	34,535	34,694	34,853	35,012	35,171	35,330	35,489	35,648	35,807	35,966	36,125	36,284	36,443	36,602	36,761	36,920	37,079	37,238	37,397	37,556	37,715	37,874	38,033	38,192	38,351	38,510	38,669	38,828	38,987	39,146	39,305	39,464	39,623	39,782	39,941	40,100	40,259	40,418	40,577	40,736	40,895	41,054	41,213	41,372	41,531	41,690	41,849	42,008	42,167	42,326	42,485	42,644	42,803	42,962	43,121	43,280	43,439	43,598	43,757	43,916	44,075	44,234	44,393	44,552	44,711	44,870	45,029	45,188	45,347	45,506	45,665	45,824	45,983	46,142	46,301	46,460	46,619	46,778	46,937	47,096	47,255	47,414	47,573	47,732	47,891	48,050	48,209	48,368	48,527	48,686	48,845	49,004	49,163	49,322	49,481	49,640	49,799	49,958	50,117	50,276	50,435	50,594	50,753	50,912	51,071	51,230	51,389	51,548	51,707	51,866	52,025	52,184	52,343	52,502	52,661	52,820	52,979	53,138	53,297	53,456	53,615	53,774	53,933	54,092	54,251	54,410	54,569	54,728	54,887	55,046	55,205	55,364	55,523	55,682	55,841	56,000	56,159	56,318	56,477	56,636	56,795	56,954	57,113	57,272	57,431	57,590	57,749	57,908	58,067	58,226	58,385	58,544	58,703	58,862	59,021	59,180	59,339	59,498	59,657	59,816	59,975	60,134	60,293	60,452	60,611	60,770	60,929	61,088	61,247	61,406	61,565	61,724	61,883	62,042	62,201	62,360	62,519	62,678	62,837	62,996	63,155	63,314	63,473	63,632	63,791	63,950	64,109	64,268	64,427	64,586	64,745	64,904	65,063	65,222	65,381	65,540	65,699	65,858	66,017	66,176	66,335	66,494	66,653	66,812	66,971	67,130	67,289	67,448	67,607	67,766	67,925	68,084	68,243	68,402	68,561	68,720	68,879	69,038	69,197	69,356	69,515	69,674	69,833	69,992	70,151	70,310	70,469	70,628	70,787	70,946	71,105	71,264	71,423	71,582	71,741	71,900	72,059	72,218	72,377	72,536	72,695	72,854	73,013	73,172	73,331	73,490	73,649	73,808	73,967	74,126	74,285	74,444	74,603	74,762	74,921	75,080	75,239	75,398	75,557	75,716	75,875	76,034	76,193	76,352	76,511	76,670	76,829	76,988	77,147	77,306	77,465	77,624	77,783	77,942	78,101	78,260	78,419	78,578	78,737	78,896	79,055	79,214	79,373	79,532	79,691	79,850	80,009	80,168	80,327	80,486	80,645	80,804	80,963	81,122	81,281	81,440	81,599	81,758	81,917	82,076	82,235	82,394	82,553	82,712	82,871	83,030	83,189	83,348	83,507	83,666	83,825	83,984	84,143	84,302	84,461	84,620	84,779	84,938	85,097	85,256	85,415	85,574	85,733	85,892	86,051	86,210	86,369	86,528	86,687	86,846	87,005	87,164	87,323	87,482	87,641	87,800	87,959	88,118	88,277	88,436	88,595	88,754	88,913	89,072	89,231	89,390	89,549	89,708	89,867	90,026	90,185	90,344	90,503	90,662	90,821	90,980	91,139	91,298	91,457	91,616	91,775	91,934	92,093	92,252	92,411	92,570	92,729	92,888	93,047	93,206	93,365	93,524	93,683	93,842	94,001	94,160	94,319	94,478	94,637	94,796	94,955	95,114	95,273	95,432	95,591	95,750	95,909	96,068	96,227	96,386	96,545	96,704	96,863	97,022	97,181	97,340	97,499	97,658	97,817	97,976	98,135	98,294	98,453	98,612	98,771	98,930	99,089	99,248	99,407	99,566	99,725	99,884	100,043	100,202	100,361	100,520	100,679	100,838	100,997	101,156	101,315	101,474	101,633	101,792	101,951	102,110	102,269	102,428	102,587	102,746	102,905	103,064	103,223	103,382	103,541	103,700	103,859	104,018	104,177	104,336	104,495	104,654	104,813	104,972	105,131	105,290	105,449	105,608	105,767	105,926	106,085	106,244	106,403	106,562	106,721	106,880	107,039	107,198	107,357	107,516	107,675	107,834	107,993	108,152	108,311	108,470	108,629	108,788	108,947	109,106	109,265	109,424	109,583	109,742	109,901	110,060	110,219	110,378	110,537	110,696	110,855	111,014	111,173	111,332	111,491	111,650	111,809	111,968	112,127	112,286	112,445	112,604	112,763	112,922	113,081	113,240	113,399	113,558	113,717	113,876	114,035	114,194	114,353	114,512	114,671	114,830	114,989	115,148	115,307	115,466	115,625	115,784	115,943	116,102	116,261	116,420	116,579	116,738	116,897	117,056	117,215	117,374	117,533	117,692	117,851	118,010	118,169	118,328	118,487	118,646	118,805	118,964	119,123	119,282	119,441	119,600	119,759	119,918	120,077	120,236	120,395	120,554	120,713	120,872	121,031	121,190	121,349	121,508	121,667	121,826	121,985	122,144	122,303	122,462	122,621	122,780	122,939	123,098	123,257	123,416	123,575	123,734	123,893	124,052	124,211	124,370	124,529	124,688	124,847	125,006	125,165	125,324	125,483	125,642	125,801	125,960	126,119	126,278	126,437	126,596	126,755	126,914	127,073	127,232	127,391	127,550	127,709	127,868	128,027	128,186	128,345	128,504	128,663	128,822	128,981	129,140	129,299	129,458	129,617	129,776	129,935	130,094	130,253	130,412	130,571	130,730	130,889	131,048	131,207	131,366	131,525	131,684	131,843	132,002	132,161	132,320	132,479	132,638	132,797	132,956	133,115	133,274	133,433	133,592	133,751	133,910	134,069	134,228	134,387	134,546	134,705	134,864	135,023	135,182	135,341	135,500	135,659	135,818	135,977	136,136	136,295	136,454	136,613	136,772	136,931	137,090	137,249	137,408	137,567	137,726	137,885	138,044	138,203	138,362	138,521	138,680	138,839	139,000	139,159	139,318	139,477	139,636	139,795	139,954	140,113	140,272	140,431	140,590	140,749	140,908	141,067	141,226	141,385	141,544	141,703	141,862	142,021	142,180	142,339	142,498	142,657	142,816	142,975	143,134	143,293	143,452	143,611	143,770	143,929	144,088	144,247	144,406	144,565	144,724	144,883	145,042	145,201	145,360	145,519	145,678	145,837	146,000	146,159	146,318	146,477	146,636	146,795	146,954	147,113	147,272	147,431	147,590	147,749	147,908	148,067	148,226	148,385	148,544	148,703	148,862	149,021	149,180	149,339	149,498	149,657	149,816	150,000	150,159	150,318	150,477	150,636	150,795	150,954	151,113	151,272	151,431	151,590	151,749	151,908	152,067	152,226	152,385	152,544	152,703	152,862	153,021	153,180	153,339	153,498	153,657	153,816	153,975	154,134	154,293	154,452	154,611	154,770	154,929	155,088	155,247	155,406	155,565	155,724	155,883	156,042	156,201	156,360	156,519	156,678	156,837	157,000	157,159	157,318	157,477	157,636	157,795	157,954	158,113	158,272	158,431	158,590	158,749	158,908	159,067	159,226	159,385	159,544	159,703	159,862	160,021	160,180	160,339	160,498	160,657	160,816	160,975	161,134	161,293	161,452	161,611	161,770	161,929	162,088	162,247	162,406	162,565	162,724	162,883	163,042	163,201	163,360	163,519	163,678	163,837	164,000	164,159	164,318	164,477	164,636	164,795	164,954	165,113	165,272	165,431	165,590	165,749	165,908	166,067	166,226	166,385	166,54