List of available methods and related standards

Institute for Paper, Pulp and Fibre Technology

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1.0   SAMPLE PREPARATION

1	**Conditioning of samples**		
	Paper and board, 23°/50%	DIN EN 20187	1993 11
		ISO 187	1990 12
		TAPPI T 402 sp-13	2013
		V/1.1/86	20.Mär.86
	Climate chamber for other testing climates described in Climate Chamber per day	ISO 554	*2015 05*

1.1   BASIC PROPERTIES

1	**Grammage**	**EN ISO 536**	**2012 07**
	Paper and board	DIN EN ISO 536	2012 11
		ÖNORM EN ISO 536	2013 02
		ISO 536	2012 07
		TAPPI T 410 om-13	2013
		V/11/57	01.Jul.57
	Corrugated board	DIN ISO 3039	2011 06
	Tissue paper	DIN EN ISO 12625-6	2017 03
		V/29.2/81	25.Mär.81

2	Grammage - CD profile		

3	**Thickness, density, bulk**	**EN ISO 534**	**2011 11**
	Paper and board	DIN EN ISO 534	2012 02
		ISO 534	*2011 11*
		TAPPI T 411 om-10	2010
	Tissue paper	DIN EN ISO 12625-3	2014 09
		V/29.3/81	25.Mär.81

4	**Measurement of hygroexpansivity, 3 climates**	DIN ISO 8226-1	1998 05
	2 climates		

5	**Dirt and shive determination in paper and board**		
	Visual estimation of impurities (mm²/m²) with TAPPI dirt count charts	DIN EN ISO 15755	1999 11
		TAPPI T 437 om-12	2012

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1.2 BASIC PROPERTIES

Moisture content Oven-drying method (paper and board)		**EN ISO 287**	**2009 06**
		ISO 287	2009 06
		DIN EN ISO 287	2009 09
		TAPPI T 412 om-11	2011
	Tissue paper	DIN 54540-9	2007 10

2	**Ash**		**DIN 54370**	**2007 06**
	Paper and board, 900°C		ISO 2144	*2015 05*
			T 413 om-11	2011
			IV/40/77	15.Sep.77
	Pulp, 575°C		ISO 1762	2015 06
	525°C		TAPPI T 211 om-12	2012

3	**Fiber analysis microscopy, qualitatively with photos**		ISO 9184-1	1990 12
			TAPPI T 401 om-15	2015
			IV/55/74	01.Dez.74
	Fiber analysis microscopy, qualitatively without photos			

4	**Filler distribution in z-direction**	VAP-method	

5	**pH of aqueous extracts - hot extraction**		**ISO 6588-2**	**2012 11**
			DIN 53124	1998 08
			TAPPI T 435 om-11 (paper)	2011
			TAPPI T 252 om-12 (pulp)	2012
	for contact with food		ÖNORM EN 647	1994 03
			DIN EN 647	1994 01
	Cellulosic papers for electrical purposes		DIN EN 60554-2	2002 12

6	**pH of aqueous extracts - cold extraction**		**ISO 6588-1**	**2012 11**
			DIN 53124	1998 08
			TAPPI T 509 om-11	2011
	for contact with food		ÖNORM EN 645	1994 03

7	**Acid-insoluble ash**		ISO 776	2011 08
			DIN 54373	2015 11
			IV/49/69	29.Sep.69

8	**Acetone-soluble matter**		DIN EN ISO 14453	*2014 09*
			ÖNORM EN ISO 14453	*2014 06*
			SCAN-CM 49:03	2003
	dichloromethane-extract		TAPPI T 204 cm-07	2007
			IV/43/67	23.Okt.67

9	**Conductivity of aqueous extracts**		ISO 6587	1992 04
			DIN EN 60554-2	2002 12

10	**Detection of starch**	Merck, S 298	

1.3 STRENGTH PROPERTIES

1	**Tensile strength, stretch at break, tensile index**		**EN ISO 1924-2**	**2008 12**
	tensile energy absorption		DIN EN ISO 1924-2	2009 05

		ISO 1924-2	*2008 12*
		V/12/57	01.Jul.57
		TAPPI T 494 om-13	2013
	Constant rate of elongation (100 mm/min)	ISO 1924-3	2005 07
	Tissue paper	DIN EN ISO 12625-4	2017 03
	tensile strength of perforated lines - Calculation of perforation efficiency	DIN EN ISO 12625-12	*2010 05*
2	**Tensile strength after immersion in water**	**ISO 3781**	**2011 09**
		DIN ISO 3781	2012 07
		SCAN-P 20:95	1995
	Tissue paper	DIN EN ISO 12625-5	2017 03
	Initial wet tensile strength with blotting paper	VAP-Method	
3	**Bursting strength, burst index**	**ISO 2758**	**2014 12**
	Paper	**DIN EN ISO 2758**	**2014 12**
		TAPPI T 403 om-10	2010
		V/12/57	01.Jul.57
	Board	**ISO 2759**	**2014 10**
		DIN EN ISO 2759	**2014 10**
		TAPPI T 807 om-11 (einwellig	2011
		TAPPI T 810 om-11 (Liner)	2011
4	**Bursting strength after immersion in water**	DIN ISO 3689	1994 07
		ISO 3689	1983 09
		ZM VIII/1/66	1966
5	**Tear resistance, tear index (Elmendorf) per direction**	**EN ISO 1974**	**2012 05**
		ÖNORM EN ISO 1974	2012 07
		DIN EN ISO 1974	*2012 09*
		ISO 1974	2012 05
		TAPPI T 414 om-12	2012
		V/12/57	01.Jul.57

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| 6 | **Tear test - Brecht-Imset-method, per direction** | DIN 53115 | 2008 05 |
| | | V/12/57 | 01.Jul.57 |

7	**Folding endurance / double folds (Schopper method)**	**ISO 5626**	**1993 11**
	per direction	TAPPI T 423 cm-07	2007
		V/12/57	01.Jul.57

8	**Flat crush of corrugated medium (CMT test)**	**EN ISO 7263**	**2011 02**
		DIN EN ISO 7263	2011 05
		ÖNORM EN ISO 7263	2011 05
		ISO 7263	*2011 02*
		TAPPI T 809 om-11	2011

9	**Flat crush test (FCT)**	DIN EN ISO 3035	2012 02
		ISO 3035	2011 11
		TAPPI T 808 om-13	2013

| 10 | **Internal bond strength (z-direction)** | TAPPI T 541 om-10 | 2010 |

| 11 | **Internal bond strength (Scott-Bond), per direction** | ISO 16260 | 2016 06 |
| | | TAPPI T 569 om-14 | 2014 |

| 12 | **Ring crush test (RCT), per direction** | ISO 12192 | 2011 09 |
| | | TAPPI T 822 om-11 | 2011 |

| 13 | **Surface strength of paper - wax picking test (Dennison)** | TAPPI T 459 om-13 | 2013 |
| | per Side | | |

| 14 | **Folding endurance - mechanical pulp (Schopper method)** | ZM VI/1/66 | |
| | per direction | Korn Burgstaller S193 | |

| 15 | **Ageing resistance** | DIN ISO 9706 | 2010 02 |
| | **Ageing resistance, climate chamber per day** | VAP-Method | |

| 16 | **Residual tensile strength after fold** | VAP-Method | |

| 17 | **E - module, per direction** | VAP-Method | |
| | (Zwick-Equipment Manual + Optimization of the parameters) | | |

| 18 | **Compression strength, short span test (SCT)** | **DIN 54518** | **2004 03** |
| | Short-span test | ISO 9895 | 2008 10 |

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1.4 FORCE-DEFORMATION BEHAVIOR

1	**Force-elongation curves (Zwick)**	**EN ISO 1924-2**	**2008 12**

2	**Elastic modulus, tensile energy absorption**	**EN ISO 1924-2**	**2008 12**
		ISO 1924-2	2008 12
		TAPPI T 494 om-13	2013
	(measured together with tensile strength)		

3	**Bending stiffness (L&W), per direction**	**ISO 2493-1**	**2010 11**
		SCAN-P 29:95	1995
		V/20/70	02.Jun.70
		VIII/5/68	19.Nov.68

4	**Bending resistance (Taber, conversion from L&W)**	TAPPI T 489 om-13	2013

1.5 SURFACE PROPERTIES

1	**Smoothness (Bekk), per side**	**DIN 53107**	**2016 05**
		ISO 5627	2002 06
		TAPPI T 479 cm-09	2009
		V/23/73	17.Apr.73

2	**Roughness/smoothness (Bendtsen), per side**	**ISO 8791-2**	**2013 09**
		DIN 53108	*2011 01*
		V/24/73	17.Apr.73

3	**Roughness of paper and paperboard (PPS), per side**	DIN ISO 8791-4	2008 05
		TAPPI T 555 om-15	2015
		BS 6563:1985	1985

4	**Hardness (Bendtsen) - according to Büchel**	Equipment Manual	

5	**Hardness (Bekk), per side**	Korn Burgstaller, S 230	

6	**Coefficient of static friction**	DIN 53119-2	1997 07
	5 samples each, per side and direction (20 samples)	ÖNORM A 5506	1993 12
		TAPPI T 815 om-12	2012

7	**Compressibility and roughness of paper (UST)**	VAP-Method
	Surface topography with and without load (UST)	VAP-Method
	rate per hour	

8	**Surface topography together with optical surface image (IFM)**	
	Alicona IFM	VAP-Method
	IFM Optical Microscopy, imaging with diffusive illumination, standard: 5x5 pictures	
	Alicona IFM surface-topography, standard: 5x5 pictures	
	rate per hour	

1.6 OPTICAL PROPERTIES

1	**Brightness (Reflectance)**		
	Basics	ISO 2469	2014 08
	ISO-Brightness R457 Paper and board C/2°	**ISO 2470-1**	**2009 10**
	D65-Brightness Paper and board D65/10°	**ISO 2470-2**	**2008 11**
	Tissue D65/10°	DIN EN ISO 12625-7	2014 08
	Tisuue C/2°	DIN EN ISO 12625-15	2015-05
	CIE Whiteness D65/10° (outdoor daylight)	ISO 11475	2004 11
	CIE Whiteness C/2° (indoor)	ISO 11476	2010 08
	Florescent specimens	DIN 53145-1	2012 03
	Non-flourescent speciments	DIN 53145-2	2012 03
	Tablets for optical testing of pigments	**DIN 53163**	**1988 07**

2	**Preparation of handsheets for the measurement**	**ISO 3688**	**1999 03**
	of brightness (reflectance)	TAPPI T 525 om-12	2012

3	**Opacity**	**DIN 53146**	**2016 05**
		ISO 2471	*2008 12*
		TAPPI T 519 om-11	2011

4	**Lightness (Y)**	**DIN 53163**	**1988 07**

5	**CIELAB Color, per illuminant**		
	d/0° / C/2° / L*a*b*	ISO 5631-1	2015 11
	d/0° / D65/10° / L*a*b*	ISO 5631-2	2015 11
	d/0° / C/2° / L,a,b, Hunter, C,h	TAPPI T 527 om-13	2013

6	**CIELAB Color difference (CMC)**	

7	**ERIC 950 Effective Residual Ink Concentration**	Technidyne - Manual

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8	**Specular gloss 75°, per side**	DIN ISO 8254-1	*2009 09*
	with a converging beam, TAPPI method	ISO 8254-1	*2009 02*
		ÖNORM EN ISO 8254-1	2009 10
		TAPPI T 480 om-09 (75°)	2009

9	**Light-scattering and -absorption coefficients**	DIN 54500	2008 09
		SCAN-CM 27:00	2000

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10	**Transparency**	DIN 53147	1993 01

11	**Optical brighteners, quantitativ detection**	VAP-Method	

12	**Optical brighteners, qualitativ detection**	VAP-Method	

13	**Accerelated ageing, Yellowing (climate chamber)**	DIN ISO 5630-3	1997 06
		ISO 5630/1	1991 02
		ISO 5630/3	1996 06
		ISO 5630/4	1986 12
		TAPPI T 453 sp-13	2013

14	**Yellowness index**	DIN 6167	1980 01

15	**Image analysis, optical microscope, rate per hour** **rate per day** **´+ report (rate per hour)**	VAP-Method	

16	**High definition measurement of gloss, refractive index, microroughness (Surfoptics)** Point measurement (10) per side and sample Grid measurement (2x2cm) per side and sample Grid measurement (4x4cm) per side and sample	VAP-Method	

17	**Print density (Gretag Densitometer)**	VAP-Method	

1.7   STRUCTURAL PROPERTIES OF PAPER

1	**Formation index (MK-Tester)** CD-profile per DIN A4	M/K II- Manual	

2	**Formation; transmitted light scanner (PTS DOMAS system)** one DIN A4 (4 single measurements)	VAP-Method	

3	**High-resolution formation measurement (beta radiography)** **max. grammage 130 g/m²** evalution by image analysis	VAP-Method	

4	**Fiber orientation in z-direction; FO angle, anisotropy** Cleavage of 3 strips (~30 layers), Matlab Cleavage of 3 strips (~30 layers), Optimas / Excel	VAP-Method VAP-Method	

5	**Layer seperation** corresponding to A5 per layer Basis weight of layers of corrugated board	VAP-Method ÖNORM A 5502	 2010 03

6	**Coating coverage (burnout test)** with image analysis	VAP-Method	

7	**Coating thickness distribution (Microtomy images), video sequences**	VAP-Method	

1.8 PRINTABILITY PROPERTIES

1	**Resistance to picking (IGT Tester), per side and direction**	IGT-Manual	

2	**Penetration print (IGT Tester)**	IGT-Manual	

3	**Ink setting, visual assessment** Ink setting for specified ink-paper combinations + Color density measurement (Gretag)	IGT-Manual V/32/99 Gretag - Manual	1999

4	**Print gloss (Prüfbau)** (incl. Gloss-Lehmann)	Prüfbau-Manual	

5	**Color density measurement (Gretag) per tone level**	VAP-Method	

6	**Ink penetration on paper cross sections** full tone, 100mm, measurement every 5 µm	VAP-Method	

7	**IASU print unevenness (Mottling index) per tone level**	VAP-Method	

8	**Printing dot analysis (single dot) per tone level (3000 dots)**	VAP-Method	

9	**PF-Method** 4 stripes (1x15cm, 8points)	VAP-Method	

10	**Structure of printing ink penetration** 6 per side and sample	VAP-Method	

11	**Ink penetration (Microtome, Image Analysis)**	VAP-Method	

1.9 LIQUID-PAPER INTERACTIONS

1	**Water absorbtion - Cobb method, per side**	**ISO 535** DIN EN ISO 535 TAPPI T 441 om-13	**2014 02** 2014 06 2013

2	**Oil absorption (Cobb-Unger), per side**	SCAN-P 37:77	1977

3	**Grease resistance 3M KIT Test (Castor oil)** Grease permeability KIT Test	3M - Manual TAPPI T 559 cm-12	2012

4	**Capillary rise - Klemm method, per direction** Suction velocity sec (0-10mm)	DIN ISO 8787 ISO 8787 VAP-Method (UA 2755)	1994 06 1986 08
5	**Writing properties by ink, per side** (pen-stroke-method)	DIN 53126	2011 11
6	**Water absorption and swelling, water immersion**	DIN 53129 VIII/2/67	*2011 11* 01.Nov.67
7	**Wet elongation, 5 per sample and direction + diagram** Tissue	VAP-Method DIN 54540-5 V/29.5/81 Korn Burgstaller S241	*2007 10* 25.Mär.81
8	**Wet Stretching of paper under one sided Liquid contact (WSD)** 5 measurements per side + diagram	VAP-Method	
9	**Penetration measurements with aqueous solutions (PDA)** Standard (3 min) H_2O (10 measurements per side) others (Slurrys, Oils) Analysis in Excel	VAP-Method	
10	**Penetration measurements with aqueous solutions (PEA)** Standard (2 min) H_2O (5 measurements per side) others (Slurrys, Oils) Excel averaging curves Excel per time segment	VAP-Methode	
11	**Contact angle measurement (FIBRO), Excel** 1 liquid Only Fibro-File	T 558 om-15	2015
12	**Surface tension and polarity, Contact angle method (FIBRO)**	T 558 om-15	2015
13	**Water retention value (WRV)**	ISO 23714 IV/33/57	2014 02 01.Jän.57
14	**Water-absorption time and water-absorption capacity** Tissue, wire basket	**EN ISO 12625-8** DIN EN ISO 12625-8	**2011 04** 2011 04
15	**Dissolution behavior of tissue papers, flake content**	VAP-Method	2007 09

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1.10 BARRIER PROPERTIES AGAINST GASES AND LUIQUIDS

1	**Air permeability - Bendtsen method**	**ISO 5636-3**	**2013 11**
		DIN 53120-1	2017 07
		V/26/75	15.Sep.75
2	**Air permeability - Gurley method**	**ISO 5636-5**	**2013 11**
		T 460 om-11	2011
3	**Water vapour transmission rate - Dish method**	**ISO 2528**	**1995 09**
		DIN 53122-1	2001 08
	building materials and products	DIN EN ISO 12572	2001 09
	Flexible sheets for waterproofing	DIN EN 1931	2001 03
		TAPPI T 448 om-09, 23/50	2009

2 *TESTING OF PULPS AND ADDITIVES*

2.0 CHEMICAL PULP; MECHANICAL PULP AND WASTE PAPER TESTING

1	**Laboratory cooking**	VAP-Method	
2	**Yield determination**	VAP-Method	
3	**Laboratory bleaching**	VAP-Method	
4	**Disintegration**		
	Chemical pulps	DIN EN ISO 5263-1	2004 12
	Mechanical pulps	DIN EN ISO 5263-2	2004 12
5	**Hot-Disintegration of mechanical pulps at >= 85 °C**	DIN EN ISO 5263-3	2004 12
6	**Laboratory beating Jokro mill**	DIN 54360	2004 07
		V/5/60	01.Nov.61
	Beating to a certain freeness, all freeness levels are charged extra		
7	**Laboratory beating PFI-mill**	ÖNORM EN ISO 5264-2	2011 05
		ISO 5264/2	2011 02
		TAPPI T 248 sp-15	2015
	Beating to a certain freeness, all freeness levels are charged extra		
8	**Laboratory beating Valley beater**	ISO 5264/1	1979 07
	up to 4 beating levels point		
	any further beating level		
	Beating to a certain freeness		

9	**Drainability Schopper-Riegler-value, CSF-value**	**EN ISO 5267-1**	**2000 07**
		DIN ISO 5267-1	2000 10
		ISO 5267/1	2001 03
		ÖNORM EN ISO 5267-1	2000 10
		V/7/61	01.Jul.61
10	**Drainage time of pulp**	see above	
11	**Fines fraction by weight of paper stock by wet screening (Britt-Jar)**	VAP-Method	
		T 261 cm-10	2010
		ISO 10376	*2011 04*
12	**Washing of Pulp**	VAP-Method	
13	**Stock concentration (Rapid method)**	**EN ISO 4119**	**1996 04**
		ISO 4119	1995 06
		DIN EN ISO 4119	1996 05
		ÖNORM EN ISO 4119	1999 06
14	**Dry matter content**	**EN ISO 638**	**2008 10**
		ISO 638	2008 10
		DIN EN ISO 638	2009 01
		ÖNORM EN ISO 638	2009 04
		IV/42/67	23.Okt.67
15	**Ash in pulp (575°C)**	ISO 1762	2015 06
16	**Handsheet forming (Rapid-Köthen), 1 pulp**	**EN ISO 5269-2**	**2004 12**
	up to 10 sheets	ISO 5269/2	*2004 11*
		DIN EN ISO 5269-2	*2005 03*
		ÖNORM EN ISO 5269-2	2005 04
	each additional fiber component		
	5 hand sheets free shrunk	VAP-Method	
	any further		
	Addition of slurry on certain filler content	VAP-Method	
	Addition of additives, per add	VAP-Method	
	Hand sheets for dirt in pulp, in according to	TAPPI T 213 om-10	2010
17	**Initial wet strength (g/30mm)**	VI/1/66	1966
18	**Content of flakes**	V/18/62	01.Sep.62
19	**Dirt in pulp** Büchner, 200 g/m²	TAPPI T 213 om-15	2015
20	**Shive content and fiber classification (Brecht-Holl method)**	VI/1/66	03.Feb.66
	mesh 50	III/14/69	01.Dez.69
	slotted screen only		
21	**Shive content and fiber classification (McNett method)**	**TAPPI T 233 cm-06**	**2006**
		SCAN-CM 6:05	2005
		V/1.4/86	20.Mär.86

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22	**Screening of pulp (Somerville)**	TAPPI T 275 sp-12	2012

23	**Fiber dimensions - Curl** Fiber Tester Excel without Coarseness (Standard) Excel with Coarseness (Standard)	ISO 16065-2	2014 01

24	**Kappa-number, with known dry matter content**	ISO 302 DIN 54357 TAPPI T 236 om-13 IV/37/80	2015 08 1978 08 2013 07.Jul.80

25	**Viscosity of pulp (CED)** Measurement of the average viscometric degree of polymerization of new and aged cellulosic electrical insulating materials	ISO 5351 TAPPI T 230 om-13 DIN EN 60450	2010 02 2013 *2008 03*

26	**Alphacellulose in pulp** **Alkali resistance** **Betacellulose in pulp** **Gamma-cellulose in pulp**	ISO 699 TAPPI T 203 cm-09 IV/39/67 DIN 54355	2015-04 2009 20.Feb.67 1977 11

27	**Alkali reserve (volumetric)**	ISO 10716	1994 12

28	**Copper number**	Zellcheming IV/8/70	1970

2.1 TESTING OF FILLERS AND COATING PIGMENTS

1	**Moisture content of fillers (oven dry method)**	VAP-Method	

2	**Dry matter content of fillers**	VAP-Method	

3	**Slurry preparation of dry fillers**	VAP-Method	

4	**Tablets for optical testing of pigments**	DIN 53163 SCAN-P 89:03 TAPPI T 534 om-09	1988 07 2003 2009

5	**Test for pigments and fillers - pH value of an aqueous suspension**	DIN EN ISO 787-9	1995 04

2.2 PREPARATION AND TESTING OF COATING COLOR

1	**Preparation of coating colors**	VAP-Method	

2	**Rheological properties (Paar Physica)**	VAP-Method	

Standard tests (amplitude sweep, jump test, flow curve)

3	**Viscosity of slurrys (Brookfield)**	TAPPI T 648 om-14	2014
	Starch	TAPPI T 676 cm-08	2008
		SCAN-P 50:84	1984
	Anionic and nonionic dispersing	V/27.9/98	1998 03

| 4 | **Coating with automatic hand blade instrument** | VAP-Method |

| 5 | **Pilot Coater Trials, per hour** | VAP-Method |

| 6 | **Satinage** | VAP-Method |
| | Calendering with pre-wetting in a climate chamber | VAP-Method |

| 3 | **Viscosity of slurrys (Brookfield)** | TAPPI T 648 om-14 | 2014 |

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