



TOWER PACKINGS

HISTORY

- **1970**
 - 1971. 07 Founded as "Hanbal Metalworking Company"
 - 1976. 07 Renamed as "Hanbal Metalworking Industry"
- **1980**
 - 1984. 07 Established a branch in Seoul
 - 1989. 05 Incorporated technology with Norton Chemical Process Product Corporation in U.S.
- **1990**
 - 1995. 06 Renamed as "Norton Hanbal Korea"
- **2000**
 - 2000. 04 Renamed as "Hanbal Masstech"
 - 2004. 01 Changed as "Hanbal Masstech Limited"
 - 2005. 11 Awarded "10 Million Dollars" Export Tower (KITA)
- **2010**
 - 2011. 01 Established a branch in Dubai as "Hanbal General Trading(L.L.C)"
 - 2012. 12 Awarded "30 Million Dollars" Export Tower (KITA)
 - 2013. 11 Incorporated technology with Enhanced Industrial Technologies LLC in U.S.



INTRODUCTION

Hanbal Masstech Limited[HMT] is a leading company which designs and manufactures Tower Trays, Internals, Packings, Reactor Internals, Wire Mesh Demisters, Mist Eliminators, etc. Our company has been providing these products for Chemical Companies, Oil Refineries, Petrochemical Plants, etc., as well as Engineering and Construction Companies since being founded in 1971.

We joined Norton Chemical Process Products Corporation in 1979 as Sales Representatives and worked with them as the manufacturer, Joint Venture Partner[Norton Hanbal Korea Inc.], design/manufacturer and Licensee until April 2002.

We conducted R&D with the Korea Institute of Energy Resource [KIER]. Especially noteworthy has been the R&D undertaken with the KIER, Ruhr University in Germany, and Hanbal, as a Fractional Research Inc, [FRI] member for five years under government assistance. Our R&D with KIER continues every year.

We have learned most of the design fabrication technologies from Norton CPPC, but we have some of our own that will meet our customer's specific requirements.

Since we know what and how Norton has tested, we built an indoor test facility, 12 meter indoor facility, for distribution quality tests. What we have designed is unquestionable, we conduct tests to make sure our products are perfect.

We also design and produce traditional style internals which are good for easy towers and those costs are about 30% less compared to the high performance towers.

We thank you all for your help and concerns rendered to us so far and wish to do the same in the future.

Sincerely, President & CEO

TOWER PACKINGS



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NOTE

1. Other types of packings are also available.
2. Numbers for each volume are approximate and varies depend on height and tower inside diameter.
3. Usually to be safe enough, 5~10% extra volume should be ordered.
4. Please consult with us for information at the time of placement of order.
5. Ceramic and Carbon Raschig Rings are also available on request.



NEW METAL RASCHIG RINGS

Pieces are approximate and weight varies depend on the thickness of material.
Available in Carbon Steel Stainless Steels of 410(S) 304(L) 316(L) 317(L) Titanium Monel
Hastelloy C Aluminum Copper and other materials such as Carbon and Ceramic on request.

Physical Data

Nominal Size Metric	10	12	16	19	25	32	38	50	75
Nominal Size Inch	3/8	1/2	5/8	3/4	1	1-1/4	1/1/2	2	3
Pieces per m ³	950000	410000	215000	120000	51000	25700	15000	6500	1900
Pieces per ft ³	26900	11610	6090	3400	1444	728	425	184	54
Void Space %	90.5	94	94.5	95.8	96	96.7	97	96.7	97.8

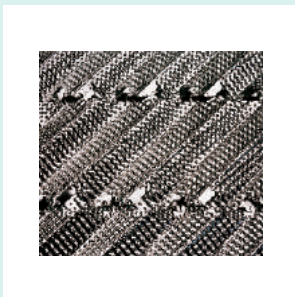


NEW METAL TOWER PACKINGS

Pieces are approximate and weight varies depend on the thickness of material.
Available in Carbon Steel Stainless Steels of 410(S) 304(L) 316(L) 317(L) Titanium Monel
Hastelloy C Aluminum Copper and other materials on request.

Physical Data

Nominal Size Metric	NMTP 15	NMTP 25	NMTP 40	NMTP 50	NMTP 60	NMTP 70
Nominal Size Inch	5/8	1	1/1/2	2	2-1/2	3
Pieces per m ³	347000	135000	51400	15000	8700	4800
Pieces per ft ³	9825	3820	1455	425	246	136
Void Space %	94.7	96.7	97.3	97.8	98.0	98.1



NEW STRUCTURED PACKINGS

Layers to be determined at the time of design by manhole size.
Available in Steels of 410(S) 304(L) 316(L) 317(L) Titanium Monel Hastelloy C Aluminum
Copper and other materials on request.

Physical Data

Type	NSP 0.5Y	NSP 1Y	NSP 1.5Y	NSP 2Y	NSP 3Y	NSP 4Y	NSP 5Y	NSP WG	NSP 250X
Height per Layer Metric	257	266	266	281	273	273	273	171	223
Height per Layer Inch	10.24	10.47	10.47	11.06	10.75	10.75	10.75	6.75	8,78
Void Space %	97.0	97.6	98.2	98.4	98.6	98.7	99.1	97	98.0



NEW METAL PALL RINGS

Pieces are approximate and weight varies depend on the thickness of material.
Available in Carbon Steel Stainless Steels of 410(S) 304(L) 316(L) 317(L) Titanium Monel Hastelloy C Aluminum Copper and other materials on request.

Physical Data

Nominal Size Metric	16	25	38	50	90
Nominal Size Inch	5/8	1	1-1/2	2	3-1/2
Pieces per m ³	215000	51000	15000	6500	1200
Pieces per ft ³	6090	1444	425	184	34
Void Space %	93	94	95	96	97



NEW PLASTIC PALL RINGS

Packing Material & Date are as shown on below. The weight is based on P.P.

Physical Data

Nominal Size Metric	16	25	38	50	90
Nominal Size Inch	5/8	1	1-1/2	2	3-1/2
Pieces per m ³	214000	51000	15000	6500	1200
Pieces per ft ³	6060	1444	425	184	34
Wt. kg/m ³	95	80	70	60	43
Wt. lb/ft ³	5.93	4.50	4.35	3.85	2.70
Void Space %	87	90	91	92	93

Packing Material & Date on Plastics

Type of Plastic	Maximum Continuous °C	Operating Temperature °F	Specific Gravity
General Grade Polypropylene	104	220	0.91
LTHA Polypropylene	119	247	0.91
LTHA Polypropylene(10% Glass reinforced)	127	260	0.97
High Density Polyethylene	100	212	0.95
Low Density Polyethylene	88	190	0.92
PVC	66	150	1.46
CPVC	85	185	1.55
Kynar ¹ PVDF	143	290	1.77
Halar ² E-CTFE	152	305	1.68
Tefzel ³ ETFE	149	300	1.70
Tefzel ³ ETFE(25% Glass reinforced)	200	392	1.86
Teflon ³ PFA	250	482	2.12

The actual temperature to be used at is the choice of customers.

C1. Trademark of Elf Atochem. 2. Trademark of Ausimont Corp. 3. Trademark of E.I. DuPont.



NEW METAL N-PAK

Pieces are approximate and weight varies depend on the thickness of material.
Available in Cabon Steel Stainless Steels of 410(S) 304(L) 316(L) 317(L) Titanium Monel
Hastelloy C Aluminum Copper and other materials on request.

Physical Data

Nominal Size	NO.1	NO. 1-1/2	NO.2	NO.3
Pieces per m ³	31400	10000	3900	1100
Pieces per ft ³	889	283	110	31
Void Space %	97	97	98	98



NEW PLASTIC SUPER SADDLES

Packing Material & Date are as shown on page 4 on Plastic. The weight is based on P.P.
Physical data for new ceramic saddles will be presented on request.

Physical Data

Nominal Size	NO.1	NO.2	NO.3
Pieces per m ³	57500	6400	1500
Pieces per ft ³	1630	181	42
Wt. kg/m ³	95	60	48
Wt. lb/ft ³	5.85	3.75	3.0
Void Space %	90	93	94



NEW PLASTIC FROSTFLAKE®

1. Packing Material & Date are as shown on page 4 on Plastic.
2. NEW PLASTIC FROSTFLAKE® has only one size and covers criteria of 1-1/2 inch, 2 inch and 3 inch Pall Rings.

Physical Data

Size	50
Pieces per m ³	4925
Pieces per ft ³	139
Wt.* kg/m ³	45
Wt.* lb/ft ³	2.8
Void Space %	95

Technical Bulletin

Mass Transfer Technology

Enhanced Type G™ High Efficiency Tower Packing (ETG)

□ Features

- Highest efficiency tower packing on the market –3” to 6” HETP’s in commercial columns
- Low pressure drop per theoretical stage, protects thermally sensitive products and intermediates
- Most compact designs for simultaneous reactions, distillations and absorptions and for direct contact heat transfer
- Widest turndown range, ease of installation, and proven scale-up factors make it ideal for lab and pilot columns.
- Linear scale-up factors make it ideal for lab and pilot columns
- Snug fit against column eliminates wall flow, avoiding the need for wall wipers and reducing the need for re-distribution



□ What are Enhanced Type G High Efficiency Tower Packings?

Manufactured from multi-strand knitted mesh, the wicking action of the capillary passages formed between the wires gives the packings their high efficiency, while high free volume maximizes capacity.

Typically 5 to 12 wires or filaments are cabled together, knit into ribbons 4” to 6” wide, and then given a crimp (see Figure 1). These corrugations are then crossed to prevent nesting and either spirally wound or vertically laminated until one unit or layer is made that covers the column’s entire cross section. Spirally wound method is only used in small columns when there is a full body flange available for installation, while vertically laminated method can also be used when the packing must go through a manway. In either construction the packing is oversized to assure a snug fit, even if the column is slightly out of round. All the wires in contact with the wall mean that the liquid running down is immediately sponged off and directed back into the packing.

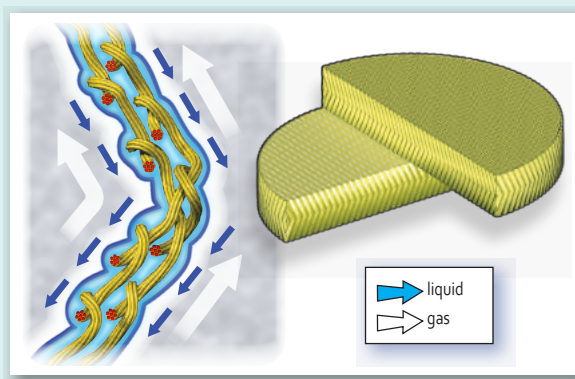
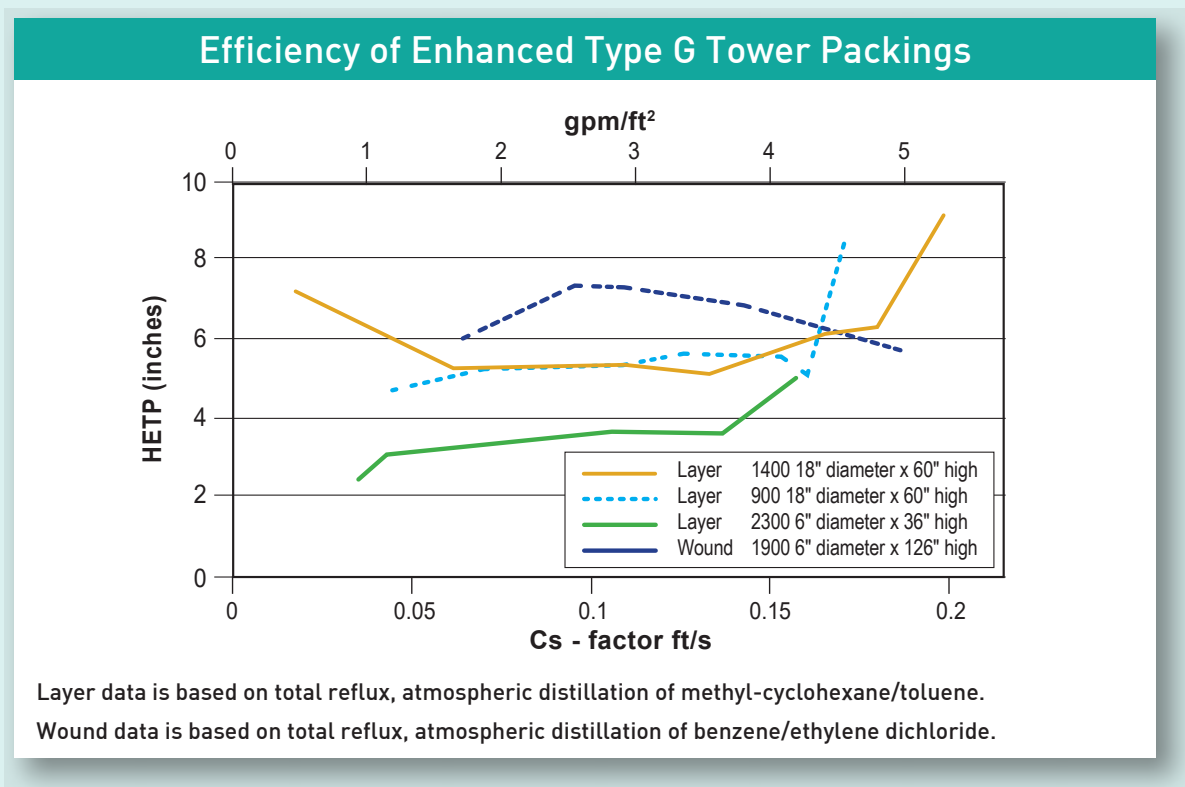


Figure 1

Constructed by knitting multi-strand "cables," of a capillary nature, that are then crimped to change direction that create tortuous passage ways for the rising vapor which promotes unsurpassed mixing.

□ How do Enhanced Type G™ High Efficiency Tower Packings work?

Capillary flow is quickly formed in the packing's numerous high-specific surface area channels which, depending on the style selected, range from 1200m²/m³ to 16000m²/m³ (see Tables 1 and 2). This yields amongst the highest effective surface areas of any packing on the market today. Thus Enhanced Type G™ High Efficiency Tower Packings have the high hold-up of liquid necessary for heat and mass transfer, which also allow chemical reactions to take place simultaneously with the physical processes of distillation or absorption. This contrasts with gauze packing where a liquid film spreads over tightly woven wires, but only has gas-to-liquid mixing on two sides of this film.



□ Specifications

HMT has the largest family of knitted wire mesh packings on the market today. Made from any metal or plastic that can be drawn into a fine wire, a product is available with the right combination of capacity, pressure drop, corrosion resistance, or cost to meet your needs.

By carefully selecting the right knit, crimp, layering, and the material that is wet the best by your process fluids; HMT engineers can guide you to a selection that will give you the most cost effective and best performing tower in your entire plant.

All data is relative to Style 1900. Available in all 300 and 400 series SS, Alloys 200, 400, 600, 800, Alloy 20, Alloy C276, aluminum, copper, nickel, phosphor bronze

Table 1 – Metal (wound or layered packing construction)

Style	2300	1900	1400	1200
Material	Metallic	Metallic	Metallic	Metallic
Surface Area, m ² /m ³	2300	1900	1400	1200
Percent Voids	93.6	94.8	96.0	94.2
HETP, Inches	3" – 5"	5" – 6"	5" – 6"	8" – 12" in Aqueous
Max. F-Factor (US Units), V√pg	2.2	2.2	2.6	2.0
Liquid Capacity, GPM/Ft ²	0.05 to 5 in Organic, to 3 in Aqueous	0.05 to 5 in Organic, to 3 in Aqueous	0.05 to 5 in Organic, to 3 in Aqueous	To 10 in Aqueous
Relative ΔP/TS	0.65	1.0	0.45	1.60
Relative Cost	1.30	1.0	0.85	0.80

Note: Layer construction is recommended for installation in columns with inside diameter larger than 305mm (12 in.).

Table 2 – DC (Dual Component-metal/plastic)

Style	DC1800	DC1200	DC16000	DC16000
Material	SS/PP Mono	SS/ETFE Mono	SS/PTFE Multi	C276/PTFE Multi
Surface Area, m ² /m ³	1800	1200	16000	16000
Percent Voids	89.9	90.7	94.1	94.1
Temperature Rating, °C	150	190	200	200
HETP, Inches	8" – 10"	8" – 10"	4" – 6"	4" – 6"
Max. F-Factor (US Units), V√pg	2.6	2.6	1.6	1.6
Liquid Capacity, GPM/Ft ²	To 10 in Aqueous and Organic	To 10 in Aqueous and Organic	0.05 to 2 in Organic and Aqueous	0.05 to 2 in Organic and Aqueous
Relative ΔP/TS	0.7	0.7	3.0	3.0
Relative Cost	0.3	0.8	0.9	1.8

Table 3 – Recommended Capacity Parameter Packing Factors (F_p)

Packing Style	Column Diameter	Hydrocarbon Service	Aqueous Service
Layered 2300	≥ 6"	120	70
Layered 1900	≥ 6"	95	55
Layered 1400	≥ 6"	55	40
Wound 1900	1"	240	n/a
Wound 1900	2" – 4"	115	115*
Wound 1900	≥ 6"	75	75

* 2" Wound activated phosphor bronze

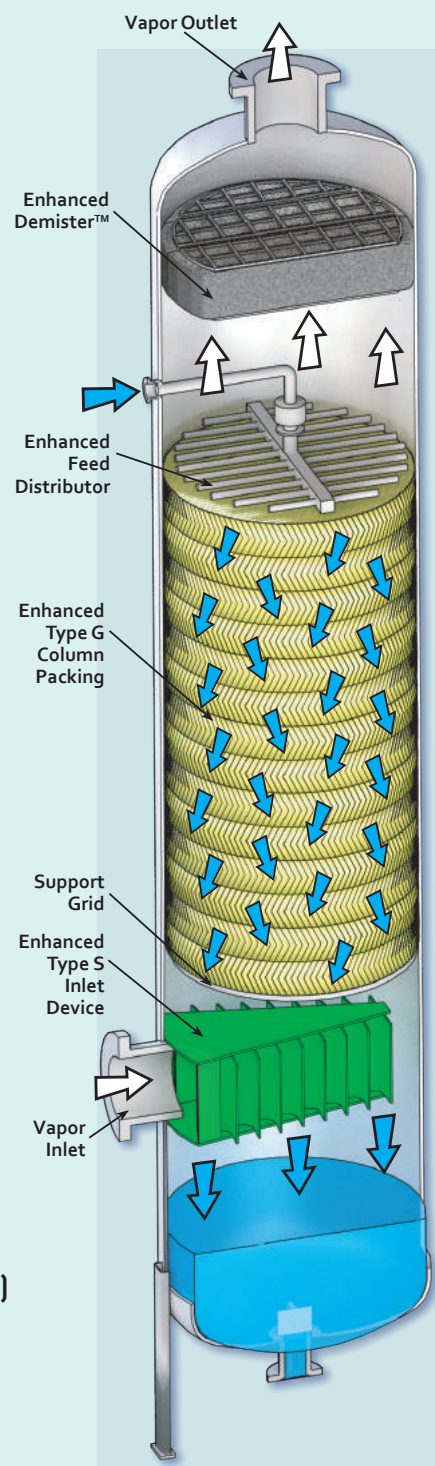


Figure 2

HMT provides complete design and supply of column internals to complement Enhanced Type G packing.

INSTALLATION AND SUPERVISION



HMT has experience in many countries such as, KOREA, THAILAND, MALAYSIA, BRAZIL, QATAR, IRAN, LIBYA, SAUDI ARABIA, INDIA, INDONESIA, EGYPT, AZERBAIJAN, CHINA, RUSSIA, and the U.S.A.[Providing complete products and components]

HMT provides field consultants to assist customers with installation of our packings anywhere in the world and many companies save time by using our installation technicians and supervisors. Please ask and we will provide you with installation manuals for your specific project.

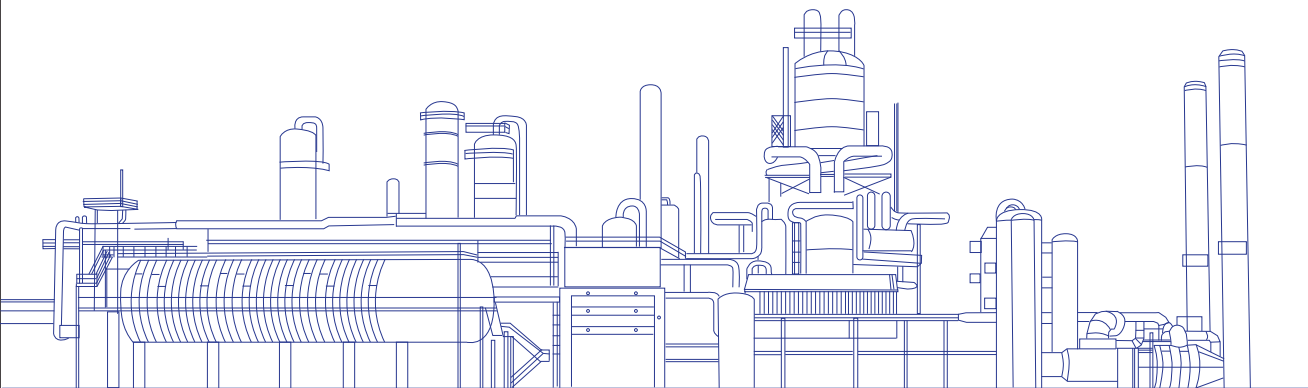
QUALITY ASSURANCE AND CONTROL POLICY

Our ultimate goal for quality assurance and control is to make sure we deliver the best in quality products with no missing parts at the exact time where they are required.

We have a long history, much experience, skilled designers, manufacturers, inspectors, supervisors, the best machines and have enough facilities to ensure our products go straight into boxes for the final shipment.

Our systems and machines fulfill most of the requirements that our customers wish us to accomplish to be their good supplier.

Please write or come see us to confirm what we say is true.



HANBAL MASSTECH LIMITED

HMT **HANBAL MASSTECH LIMITED**
MASS TRANSFER TECHNOLOGY

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