

**KERAMO**



# Fully glazed vitrified clay pipes (vcp)

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## Why Clay?

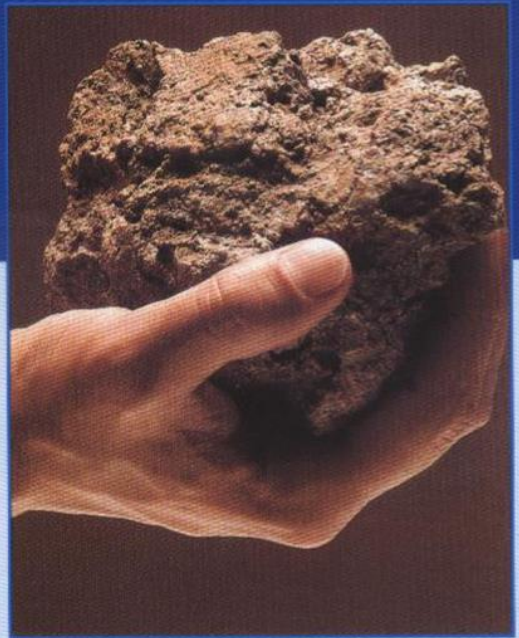
It's cheap, abundant, and readily available in most parts of the world. It is easily formed, assembled, and maintained. It has a proven record of corrosion resistance, longevity in service and reliability.

Clay is the "original" material used in water and public health engineering works. The Egyptians used fired clay containers to convey and store water 5000 years ago. Later, the Romans formed fired clay pipes to convey clean and dirty water.

Clay pipe is non-combustible. The pipe is vitrified at temperatures above 1000°C effectively eliminating any combustible material.

Clay is also extremely "green." It is by far the most environmentally-friendly material that can be used for transporting waste. Many of those re-discovered ancient pipes are found to be still be in good working condition, their corrosion resistance intact. Other sewer systems, some built as recently as the 20th century, and made of other materials, such as asbestos-cement, concrete, iron and plastics, have already deteriorated rapidly, allowing toxic material to seep into the ground.

And finally, clay pipes are easily recyclable. Unlike plastic and other pipes, they can be easily re-used and refabricated to produce new pipe material. That saves money... and helps save the environment too.

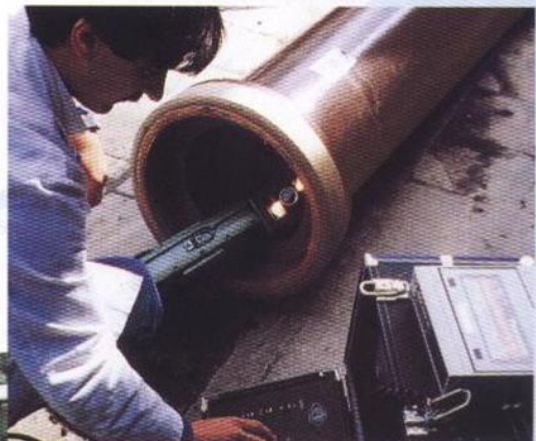
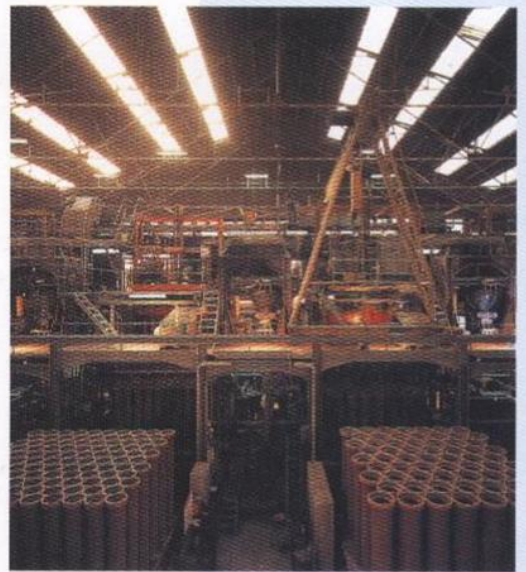




## Why Keramo (Sunway SK) ?

**Keramo (Sunway SK)** offers world class technical and economical solutions for drainage and sewerage works. We provide a complete product range of pipes and fittings made of vitrified clay in standard dimensions and diameters ranging from of 150 to 1400 mm.

- Advanced European technology
- Superior in quality
- High structural strength
- Fully glazed inside and out
- Heat and chemical resistant
- Proven durability
- Socket/spigot type with prefabricated flexible joints
- Approved to MS 1061:1999 and BS EN 295
- Safe and easy palletised packing

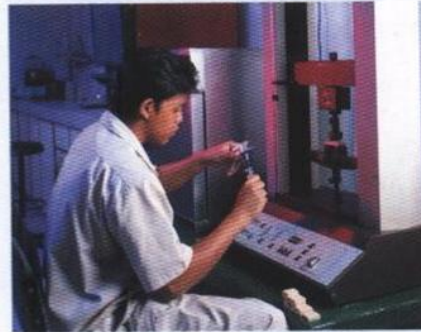




## Quality assurance, tested tough

**Keramo (Sunway SK)** pipes are manufactured to meet stringent quality control criteria. Our manufacturing process includes numerous quality control checks and testing of samples from all pipes and fittings daily. These include tests, but not limited to the following :

- accurate dimensional tolerance
- bending moment resistance
- crushing strength
- water tightness
- chemical resistance
- deflection
- shear resistance

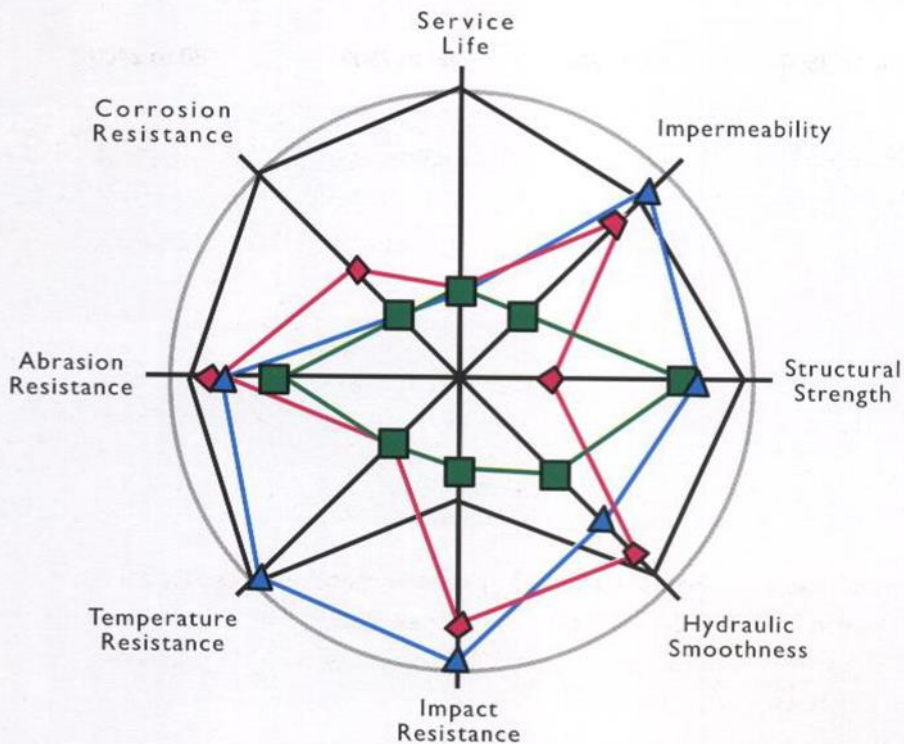
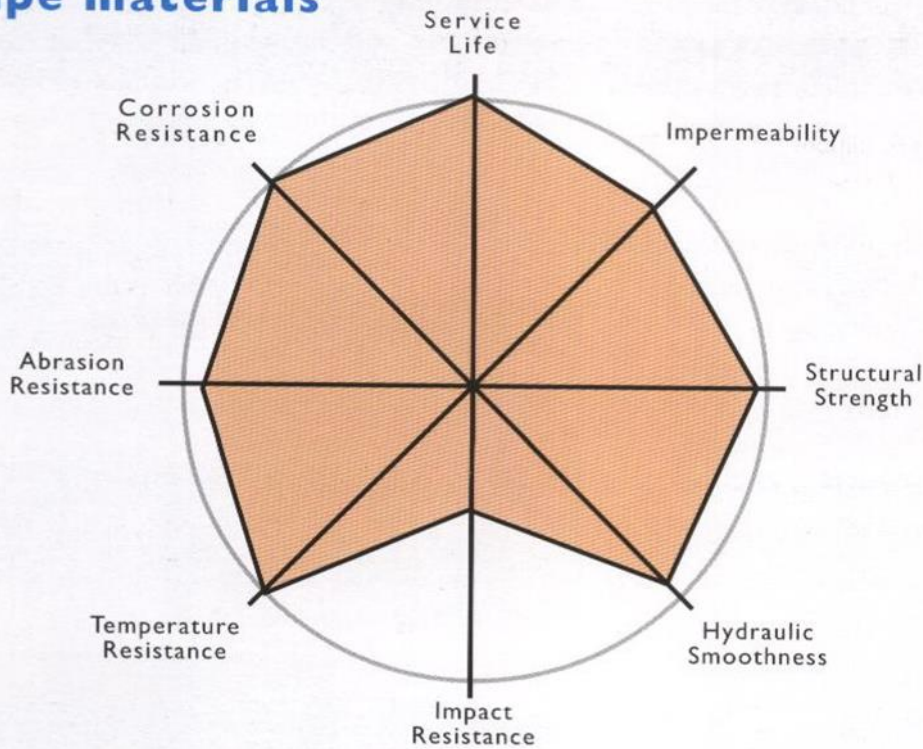




# The superiority of vitrified clay pipes (vcp)



## vcp compared with other pipe materials



**Vitrified Clay**

**PVC**

**Concrete**

**Duct. Iron**

*In systems relying on gravity operation such as foul sewers, stormwater sewers and irrigation drainage, the pipeline materials used are principally clay, concrete and plastics (PVC, GRP, polyethylene, etc.). Studies made by independent European industry analysts G. Petzow and H. Schubert attest to the superior qualities of vitrified clay. Their findings are diagrammed, utilising eight criteria which are placed as loci on a circular "performance chart." These indicate the relative advantages and disadvantages of each*

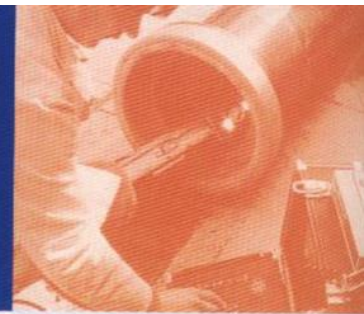


## Summary of the properties of sewer pipes

<b>Properties</b>	<b>Vitrified Clay</b>	<b>Concrete</b>	<b>PVC</b>	<b>GRP</b>	<b>Steel / DI</b>	<b>HDPE</b>
Longevity (yrs)	100+	As conditions dictate	25+	25+	As conditions dictate	Not Known
Resistance to corrosion	Very good	Poor (Protection often required)	Good	Good	Poor (Protection often required)	Good
Resistance to abrasion	Very good	Fair	Good	Good	Good	Good
Length (mm)	1500 to 2500	3000	6000	6000	6000	6000
Flexible jointing system	Yes	Yes	Yes	Yes	Yes	Yes
<b>Strengths</b>	Depending on size and strength classifications					
Sizes (mm)	150 to 1400	300 to 3600	50 to 600	80 to 2500	80 to 2400	
Design	Simple	Simple	Complex	Complex	Complex	Complex
Workmanship required in placement	Minimum	Minimum	Very careful	Very careful	Minimum	Very careful
Supervision required during placement	Minimum	Minimum	Substantial	Substantial	Minimum	Substantial
Maintenance	Minimum	Periodic check when effluents are corrosive	Periodic check for elliptical deformation	Periodic check for elliptical deformation	Usually minimum but frequent if cathodic protection provided	Periodic check for elliptical deformation



# The unique jointing system of Keramo (Sunway SK)



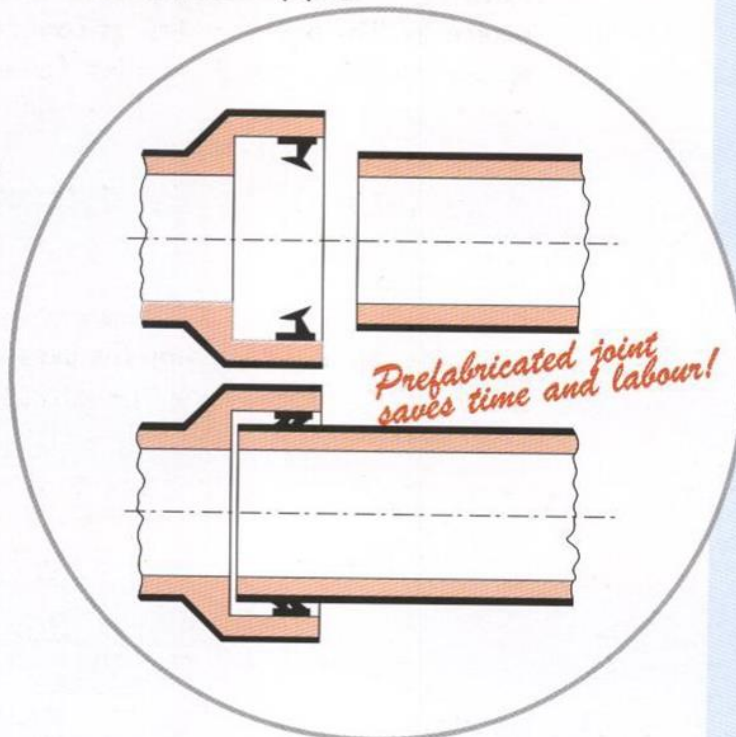
Depending on diameters and field of application, two jointing systems are used on Keramo (Sunway SK) pipes.

Both systems are designed and manufactured in accordance with the quality standards established for flexible jointed pipes.

## THE 'L' JOINT

Consists of a rubber lip ring fixed in the pipe socket with an epoxy sealant. No joint on the spigot end is required.

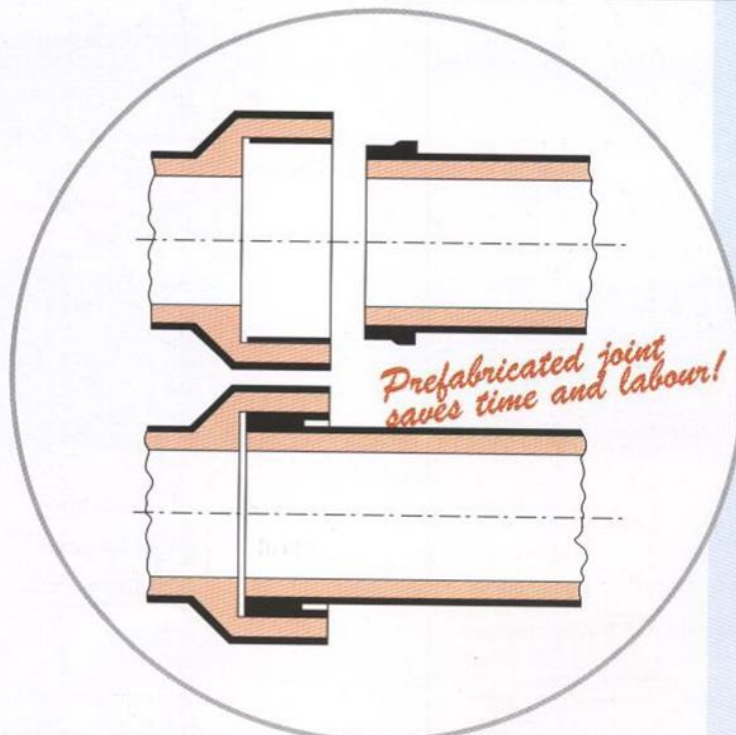
Diameters: DN 150-450 mm.



## THE 'K' JOINT

Consists of two elements, a hard polyurethane compound cast inside the socket and a soft polyurethane element on the spigot end, providing a tight and flexible connection.

Diameters: DN 200-1400 mm.



### Note:

- Within the BS EN 295 (European Standard) L and K joints refer respectively to jointing systems F and C.
- Lubricant - In order to facilitate installation of the pipe, a special lubricant should be used.



# Crushing strength comparison

## KERAMO ( SUNWAY SK ) VITRIFIED CLAY PIPES & FITTINGS

Keramo (Sunway SK) pipes are vitrified and glazed internally and externally. The pipes and fittings come complete with either prefabricated lip rings (L joint for diameters 150 - 450 mm) or conical joint (K joint for diameters 200 - 1400 mm).

### COMPARISON OF CRUSHING STRENGTH VALUES OF MS 1061:1999 AND BS EN 295

According to technical specifications and prescribed norms, a specific pipe type can be selected on the basis of following tabulation of minimum allowed crushing strengths (denominated in kilo Newton per metre, kN/m).

Pipes			MS 1061:1999					BS EN 295							
			Crushing Strength (kN/m)					Crushing Strength (kN/m)							
Diameter DN (mm)	Joint	Length (mm)	Class	Class					Class	Class					
				L	95	120	160	200		L	95	120	160	200	
150	L	1500/1750	FN 28/34							FN 28/34					
200	L	2000				24	32					24	32	40	
225	L	2000				28	36					28	36	45	
250	K	2000				30	40	50				30	40	50	
300	L	2000				36	48					36	48	60	
375	L	2000				45						45			
400	K	2000/2500				38	48	64	80			38	48	64	80
450	L	2000				54	72					54	72		
500	K	2000/2500				48	60	80				48	60	80	
600	K	2000/2500		48	57	72	96			48	57	72	96		
700	K	2000		60	67	84				60	67	84			
800	K	2000		60						60	76	96			
900	K	2000		60	85					60	85				
1000	K	2000		60	95					60	95				
1200	K	2000		60						60					
1400	K	2000		60						60					

Produced by SUNWAY KERAMO ( SUNWAY SK ), MALAYSIA

Produced by STEINZEUG KERAMO, EUROPE



# Comparison between MS 1061 : 1999 and BS EN 295 : 1991



I.	DIMENSIONS AND TOLERANCES	MS 1061:1999		BS EN 295		
		Min.	Max.	Min.	Max.	
a.	Bore	DN 150 DN 200 DN 225 DN 300 DN 375 DN 450	146 mm 195 mm 219 mm 293 mm 366 mm 439 mm	NA NA NA NA NA NA	146 mm 195 mm 219 mm 293 mm 366 mm 439 mm	NA NA NA NA NA NA
b.	Length		-1%, +4%		-1%, +4%	
c.	Squareness of ends	DN 150, DN 200, DN 225, DN 300 DN 375 DN 450	≤ 6 mm ≤ 7.5 mm ≤ 9 mm		≤ 6 mm ≤ 7.5 mm ≤ 9 mm	
d.	Straightness	DN 150 DN 200 DN 225 DN 300 DN 375 DN 450	max. 5.0 mm/m max. 5.0 mm/m max. 5.0 mm/m max. 4.0 mm/m max. 4.0 mm/m max. 4.0 mm/m		max. 4.5 mm/m max. 4.5 mm/m max. 4.5 mm/m max. 4.0 mm/m max. 4.0 mm/m max. 4.0 mm/m	
e.	Angle of curvature of bends		±5° for 45°, 90°		±5° for 45°, 90°	
f.	Branch angle of junctions		±5°		±5°	
2.	<b>PERFORMANCE REQUIREMENTS</b>					
a.	Crushing strength	DN 150 DN 200 DN 225 DN 300 DN 375 DN 450	* 34 kN/m for FN 34 * 32 kN/m for Class 160 * 36 kN/m for Class 160 * 48 kN/m for Class 160 * 45 kN/m for Class 120 * 72 kN/m for Class 160		* 34 kN/m for FN 34 * 32 kN/m for Class 160 * 36 kN/m for Class 160 * 48 kN/m for Class 160 * 45 kN/m for Class 120 * 72 kN/m for Class 160	
b.	Impermeability	pipes fittings	NA		NA	
c.	Bending moment resistance	DN 150 DN 200 DN 225	0.5 bar for 5 min * 4.0 kN.m for FN 34 * 6.2 kN.m for Class 160 * 7.4 kN.m for Class 160		0.50 bar for 5 min * 4.0 kN.m for FN 34 * 6.2 kN.m for Class 160 * 7.4 kN.m for Class 160	
d.	Water tightness		≤ 0.07 litres/m <sup>2</sup> at 0.5 bar		≤ 0.07 litres/m <sup>2</sup> at 0.5 bar	
e.	Chemical resistance	mass loss	≤ 0.25%		≤ 0.25%	
f.	Fatigue strength under pulsating load		2 × 10 <sup>6</sup> cycles		2 × 10 <sup>6</sup> cycles	
g.	Hydraulic roughness		0.02 mm - 0.05 mm		0.02 mm - 0.05 mm	
h.	Abrasion resistance		0.02 mm - 0.05 mm		0.02 mm - 0.05 mm	
3.	<b>JOINT ASSEMBLIES</b>					
a.	Internal pressure		0.05 bar & 0.5 bar		0.05 bar & 0.5 bar	
b.	External pressure		0.05 bar & 0.5 bar		0.05 bar & 0.5 bar	
c.	Angular deflection	DN 150 DN 200 DN 225 DN 300 DN 375 DN 450	80 mm/m for 5 min 80 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min		80 mm/m for 5 min 80 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min 30 mm/m for 5 min	
d.	Straight draw		NA		NA	
e.	Shear resistance		25 N/mm pipe dia 0.5 bar for 15 min		25 N/mm pipe dia 0.5 bar for 15 min	
f.	Invert conformity		5 mm for DN 150, 200, 225 and 300. 6 mm for DN 375 & DN 450		5 mm for DN 150, 200, 225 and 300. 6 mm for DN 375 & DN 450	
g.	Joint interchangeability	DN 150 (Spigot Controlled System) DN 200 (Spigot Controlled System) DN 225 (Spigot Controlled System) DN 300 (Spigot Controlled System) DN 375 (Spigot Controlled System) DN 450 (Spigot Controlled System)	(186 ± 2) mm (242 ± 3) mm (271 ± 3) mm (355 ± 4) mm (449 ± 4) mm (553 ± 5) mm		(186 ± 2) mm (242 ± 3) mm (271 ± 3) mm (355 ± 4) mm (449 ± 4) mm (553 ± 5) mm	
h.	Chemical resistance		0.05 & 0.5 bar for 5 min (complete soaking)		0.05 & 0.5 bar for 5 min (complete soaking)	
i.	Thermal cycling stability		-10°C, +70°C		-10°C, +70°C	
j.	Long term thermal stability		7 days at 45°C, 5°C, 0°C		7 days at 45°C, 5°C, 0°C	

Notes:



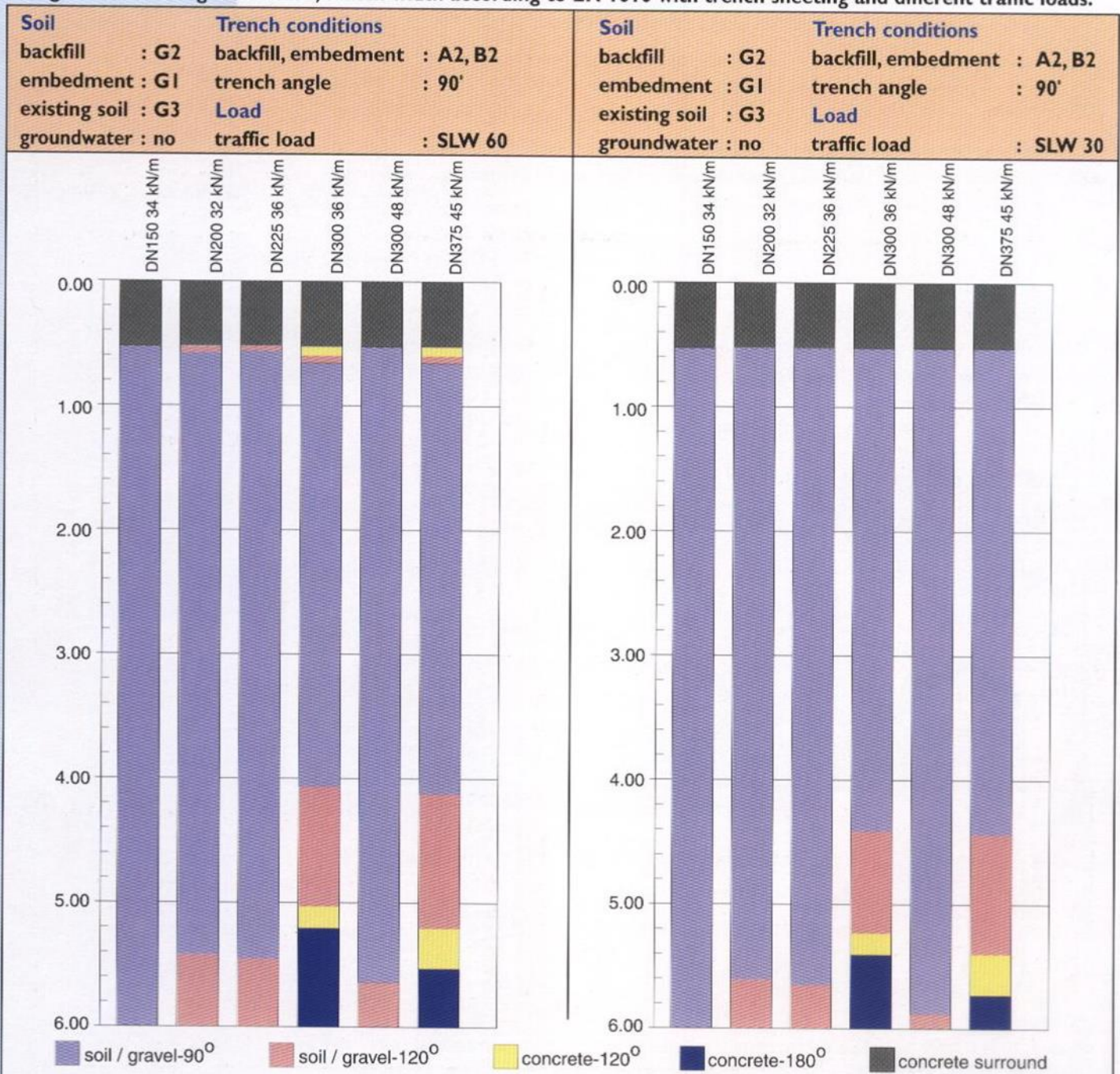
# Bedding preparation for Keramo (Sunway SK) pipes

The latest methods of manufacture and control have enabled Keramo (Sunway SK) to guarantee their pipes to be of high load bearing strengths. The total structural load that a pipeline can carry depends on the combination of the pipe bedding on which it is laid. Thus, high strength bedding can be used with low strength pipes or low strength bedding with high strength pipes.

Keramo (Sunway SK) pipes require only low bedding strengths due to their inherent strong body. In normal soil conditions (G2, G1, G3), Keramo (Sunway SK) pipes require only a flexible bedding of granular materials or laid directly on the trimmed bottom of the trench. With higher loadings, a concrete bedding can become necessary or higher strength pipes used. As a general guide, the following tables are recommended for Keramo (Sunway SK) pipes. However, depending on prevailing site conditions, other combinations of static parameters apply.

## Bedding recommendations

Single trench with groundwater, trench width according to EN 1610 with trench sheeting and different traffic loads.







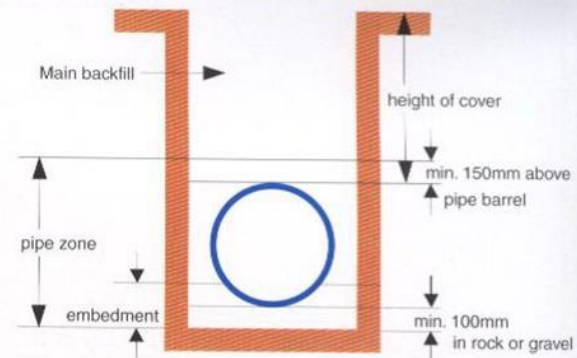
## NOMENCLATURE to A 127 (ATV - Working Sheet)

### Types of soil

- G1 : Non-cohesive soils (sand, coarse gravel or sand and gravel mixtures )
- G2 : Slightly cohesive soils (clayey sand or sand and gravel)
- G3 : Cohesive mixed soils, silt

### Conditions for backfilling of the trench above pipe zone

- A1 : In layers compacted backfill against the undisturbed soil (without identification of the degree of compaction).
- A2 : Vertical trench sheeting by means of steel piles or light interlocking steel piles, only to be removed after the backfilling of the trench. Frame-type trench shores or equipment, which are removed step-by-step in the process of the backfilling. Uncompacted trench backfilling.
- A3 : Vertical trench sheeting with heavy interlocking steel piles, poling boards, frame-type trench shoring etc., removed only after backfilling.

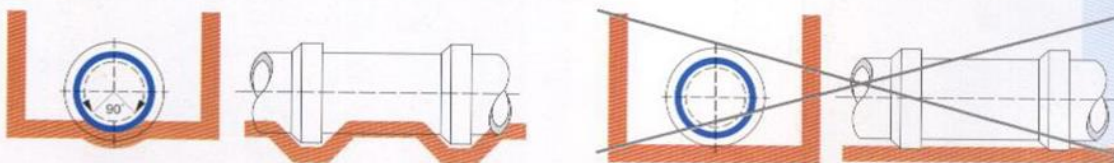
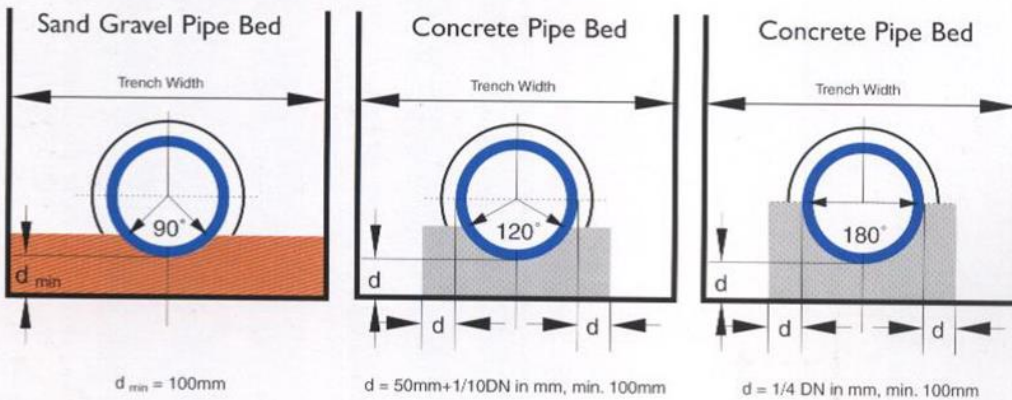


### Conditions for embedding of pipelines

- B1 : In layers compacted backfill against the undisturbed soil, or in embankment (without identification of the degree of compaction).
- B2 : Vertical trench sheeting within the pipe zone by means of steel sheet piles or light interlocking piles, only to be removed after the backfilling of the trench. Frame-type trench shores or equipment, the assumption that the compaction of the soil is assured after the removal of the equipment.
- B3 : Vertical trench sheeting within the pipe zone with heavy interlocking sheet piles, poling boards, frame-type trench shoring etc., without effective compaction after the removal of the equipment.

## TYPES of pipe bedding

to EN 1610 and ATV - working sheet A 127

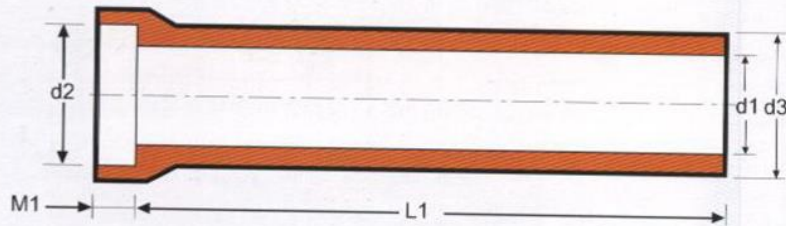


Socket holes must be made so that the sockets do not lie on a compacted bottom. This would result in point loading. Support must be provided over the whole barrel length.



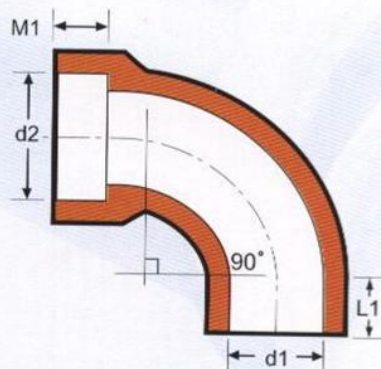


## Straight Pipes



Dimensions	Diameter DN (mm)					
	150	200	225	300	375	450
L1 (mm)	1500/1750	2000	2000	2000	2000	2000
M1 (mm)	75	75	70	70	70	75
d1 (mm)	150	200	225	300	375	450
d2 (mm)	203	262	291	376	483	585
d3 (mm)	184	242	271	355	449	548
Approx.Wt. (kg)	35/40	66	82	127	198	360

## Bends

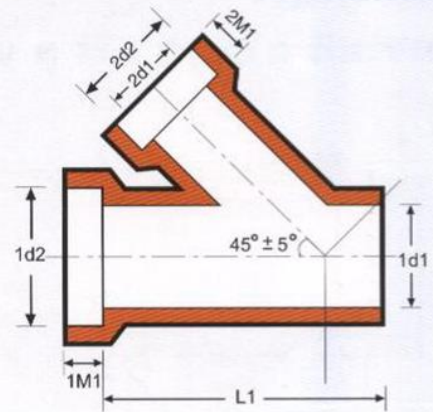


Dimensions	Diameter DN (mm)/Degree								
	150		200		225		300		375
	45°	90°	45°	90°	45°	90°	45°	90°	90°
d1 (mm)	150	150	200	200	225	225	300	300	375
d2 (mm)	203	203	262	262	291	291	376	376	483
L1 (mm)	75	75	85	85	85	85	85	85	81
M1 (mm)	70	70	70	70	70	70	70	70	70
Approx.Wt. (kg)	8	10	13	23	24	32	48	53	81



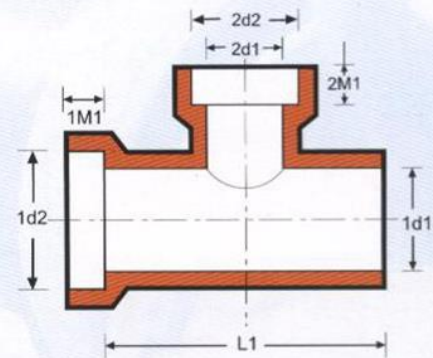
## Product range

### Wye (Oblique)



Dimensions	Diameter DN1 / DN2 (mm)						
	150/150	200/150	225/150	225/225	300/150	300/225	300/300
L1 (mm)	450	480	480	600	480	600	750
1d1 (mm)	150	200	225	225	300	300	300
1d2 (mm)	203	262	291	291	376	376	376
1M1 (mm)	70	70	70	70	70	70	70
2M1 (mm)	70	70	70	70	70	70	70
2d1 (mm)	150	150	150	225	150	225	300
2d2 (mm)	203	203	203	291	203	291	376
Approx.Wt. (kg)	21	29	36	46	49	60	70

### Tee (Square)

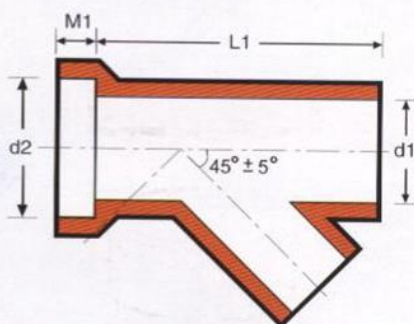


Dimensions	Diameter DN1 / DN2 (mm)									
	150/150	200/150	225/150	225/225	300/150	300/225	300/300	375/375	450/450	
L1 (mm)	400	480	480	480	480	480	600	750	750	
1d1 (mm)	150	200	225	225	300	300	300	375	450	
1d2 (mm)	203	262	291	291	376	376	376	483	558	
1M1 (mm)	70	70	70	70	70	70	70	80	80	
2M1 (mm)	70	70	70	70	70	70	70	80	80	
2d1 (mm)	150	150	150	225	150	225	300	375	450	
2d2 (mm)	203	203	203	291	203	291	376	483	558	
Approx.Wt. (kg)	16	23	28	36	43	50	52	102	112	



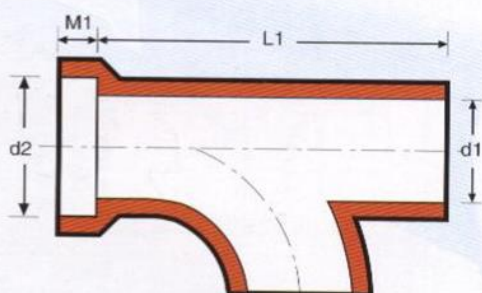


## Tumbling Bay (Oblique)



Dimensions	DN (mm)			
	150	200	225	300
d1 (mm)	150	200	225	300
d2 (mm)	203	262	291	376
L1 (mm)	460	600	600	750
M1 (mm)	70	70	70	70
Approx.Wt. (kg)	20	35	40	66

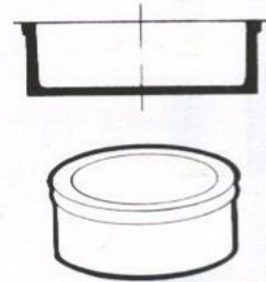
## Tumbling Bay (Curved Square)



Dimensions	DN (mm)			
	150	200	225	300
d1 (mm)	150	200	225	300
d2 (mm)	203	262	291	376
L1 (mm)	450	520	520	640
M1 (mm)	70	70	70	70
Approx.Wt. (kg)	15	24	34	63

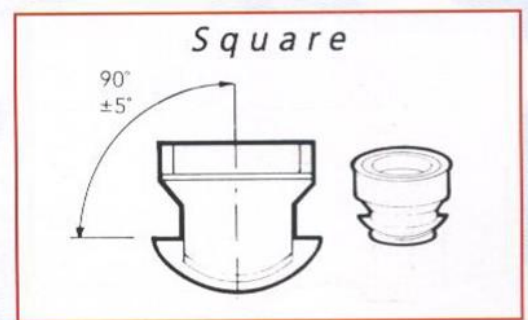


## Clay Stoppers



Diameter DN(mm)	For Joint	Weight (kg/pc)
150	L	2
200	L	4
225	L	6
300	L	10

## Saddles



Branch Diameter DN(mm)	Main line diameter			
	DN 225	DN 300-350	DN 400-600	DN 700-1200
150	x	x	x	x
200		x	x	x
225		x	x	x

When ordering, please mention DN of main line.

**Note:**

Peculiar to the ceramic manufacturing process, all weights and dimensions are as close as accurately possible.



# Accessories for use with vitrified clay pipes



KR<sub>0</sub> / KR<sub>1</sub>



KR<sub>2</sub>



KR<sub>3</sub>



KR<sub>5</sub>



KR<sub>6</sub>

## Shrinkable Sleeves

Heat shrinkable sleeves are available to secure problem joint applications, connections between different pipe materials and different diameters.

*For large dimensional differences*

Type	Type of connection	Outside pipe diameter (mm)
KR <sub>0</sub>	tubular spigot-spigot	80 - 154
KR <sub>1</sub>	tubular spigot-spigot	175 - 240
KR <sub>5</sub>	tubular spigot-spigot	105 - 190
KR <sub>6</sub>	tubular spigot-spigot or collar-spigot	173 - 310

*For limited dimensional differences*

Type	Type of connection	Availability*
KR <sub>2</sub>	wraparound spigot-spigot	DN 150 - DN 600
KR <sub>3</sub>	wraparound collar-spigot	DN 150 - DN 350

\*diameter to be specified when ordering

Produced by KERAMO (SUNWAY SK) STEINZEUG (Patent pending)



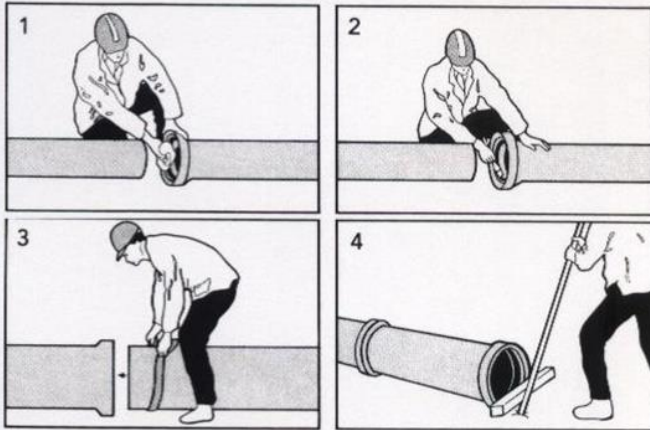
## PIPE CUTTER

Clay pipes can be cut to desired lengths by using a cutting chain for diameters up to DN300mm.

For diameters greater than DN 300mm can use portable disc cutter.



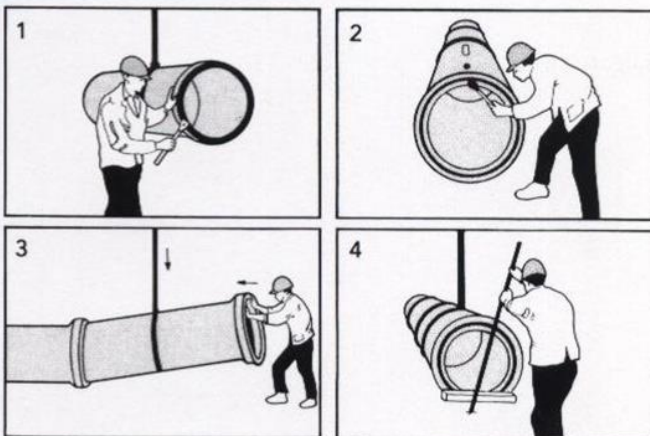
# Laying of Keramo (Sunway SK) vitrified clay pipes



## Pipes with L Joint

Instructions:

- Clean socket and spigot joints.
- Apply lubricant on inside of joint.
- Align spigot into socket.
- Push spigot into socket with crowbar.



## Pipes with K Joint

Instructions:

- Lower pipe into trench.
- Clean socket and spigot joints.
- Apply lubricant on both jointing ends.
- Align all topmarkings, where applicable, to avoid steps in the line.
- Push spigot into socket with crowbar.

## Construction of Backdrop Manholes

- With backdrop junctions.

