TECHNICAL DATA SHEET **CANNABRIC**

Brick according to the Spanish standard of pressed loam stones **UNE 41410** (December, 2008)

Cannabric is a solid brick from hemp, produced since 1999 in Guadix (province Granada), who possesses special thermal, acoustic and bio-climatic qualities. Among other things, the hemp-brick was developed specially for massive, carrying outer walls. Because it consists of completely natural raw materials (vegetable material, natural and mineral bonding agents and recycled materials), it is recommended for those architects and owners who want to build environmentally responsible and create **homelier, more comfortable and healthier spaces**, which are also of high quality and durability.

the hemp

Main component of Cannabric is the wooden stalk of hemp, a fast-growing versatile plant, cultivated for thousands of years, which improves soils, can be grown without pesticides and herbicides and from which all parts are usable. The ranges of application are not only the construction but also, textile-, paper-, cosmetic-, pharma-, food-, car- and furniture-industry.
The industrial hemp cultivars are completely legal, because they have a very low THC (hallucinogen) level, a substance found only in the blossoms and high leaves, not in the stalk.

advantages by application of vegetable building materials

Using hemp in construction, and working with Cannabric in the outer- and inner walls, hemp mortars in floor slabs, and insulating boards from hemp under roof, approximately 10 tons of hemp gets applied in a dwelling-house of 100 m2, that is 100 kg of hemp per m2, replacing and avoiding toxic- and not environmental-friendly materials (for example reinforced concrete).
With the application of renewable raw materials in the building industry, one preserves the natural resources and avoids the high energy expenditure and landscape destruction with which the dismantling and the transformation of these raw materials is connected. **When building with vegetable materials one retains CO_2 and reduces the environmental impact.**

thermally, acoustically and bioclimatically comfort

Cannabric benefits from the **excellent thermal characteristics of hemp** (thermal conductivity of 0,048 W/m•k), which are by far better than the ones of wood. A further advantage over wood is that hemp is not attacked by parasits, since its stalk is free from nutrients (proteins), which is treated neither during its cultivation nor with its applications in the building industry.
The mineral components of the Cannabric are responsible for its mechanical hardness, its density and its excellent thermal inertia. The result is a brick of low thermal conductivity (0,1875 W/ m·K) and high specific thermal capacity (1303 kJ/ m3·K), possessing thermo-physical characteristics to protect against both, cold and hot climate periods. All this with one-layer walls of small thickness, without additional thermal insulation.
With the bonding agents natural materials are used, like loam (from the excavation of caves in the region of Guadix) and limes. These materials have up to very small energy expenditure in their production and possess in addition natural and bioclimatic characteristics. Lime is (contrary to cement) subject to a closed cycle, the CO_2 output when its production resembles the CO_2 absorption with its setting.
The components of Cannabric possess characteristics, which create a healthy room climate and a pleasant acoustic comfort. They provide for clean air and adjust the air humidity, so that it is important to work as well on the mortars, renders, plasters and paints with ecological materials, in order to avoid deviations.
Cannabric is a solid, earth-coloured brick of rough texture, which is not fired but air dried, using hardly any energy in its production and, to contrast with conventional materials, is highly able to “breathe”.

life time and recycling

Although Cannabric is designed for a long life time, similarly like historical building materials, and therefore counts with a hardness increase instead a hardness loss (unlike cement), recycling or reutilization is easily possible. The bricks dating from a demolition can be powdered and serve for the production of Cannabric or hemp-mortars once more.

GWP
“global warming potential”

Cannabric has a **GWP** of **- 0.624 kg CO_2eq/kg**, which is a negative carbon rating. In its manufacturing processes (materials, transport, used energy) it does not contribute to global warming.

measurements	**Cannabric is manufactured in three measurements: 30 x 14,5 x 10,5 [cm] (full brick), 14,5 x 14,5 x 10,5 [cm] (half brick), 21,5 x 14,5 x 10,5 [cm] (three-quarter brick). The supply, depending upon size, is in pallets of 195/252/390 pieces.**
uses	**The bricks have the mechanical qualities as well as the fire resistance which enable the building of single residential buildings, terraced houses and public buildings of several floors. Cannabric is suitable for the building of one-layer load bearing outer walls (3 or more floors with a wall thickness of 30 cm) and inner walls of 14,5 or 10,5 cm thickness.** **Other possible applications are:** **- carrying walls with exposed stone wall in the outside area** **- framework walls (lesser weight and better thermal properties than pure clay bricks).** **- decorative exposed brick-work** **- inner walls of straw ball buildings or as a supplement to thermally inefficient walls** **- caves facades and caves annexes** **- dwellings and stables for animals**
recommendations for processing	**With Cannabric walls should be applied hydraulic lime mortar of the classes NHL5, ore even better NHL3,5 or NHL2 (dose 1:4). With walls of small thicknesses (up to 30 cm) also the use of slaked lime mortar is possible (pay attention to suitable sand), never however the use of quicklime in powder or "so-called" slaked lime, which is won from powder-lime. Optionally one can work with hemp light mortars (from granulated hemp, hydraulic lime and sand or clay), which have similar thermal and mechanical characteristics as the Cannabric.** **Render and plaster, first layer: slaked lime mortar or hydraulic lime mortar of the classes NHL3,5 (dose 1:4).** **Render and plaster, upper layer: Long slaked lime mortar (in white, coloured or prepared for paint) or hydraulic lime mortar of the classes NHL3,5 white or NHL2.** **Plaster with natural gypsum is possible in the internal area (only use hemihydrates). There are historical gypsums, also suitable for application in the external area. The paint should be breathe-active in order to keep the characteristics of mortar (silicate paint, limewash, loam-paint, biological plant-paint…).** **In the internal area it is possible to work with Cannabric as exposed brick-work or simply to paint, while in the external area it is recommendable to render, since it diminishes thermal characteristics in rainy times, while it is wet.** **Generally the 30 cm wall thickness is suitable for the external area (also a wall thicknesses of 45 cm is possible, especially for highly energy efficient houses), while the 14,5 and 10,5 cm wall thicknesses are applicable for the internal area, plastered, if necessary.**

	consumption of 35-40 kg sacks of natural hydraulic lime per m2 Cannabric-wall, according to thickness		
wall thickness Cannabric in cm (without or before plastering)	to build up Cannabric-walls without plasterwork (dose 1:4, lime:sand)	to build up Cannabric-walls with one-sided plasterwork (dose 1:4, lime:sand)	to build up Cannabric-walls with two-sided plasterwork (dose 1:4, lime:sand)
30	**0,66**	**0,83**	**1,00**
14,5	**0,27**	**0,44**	**0,60**
10,5	**0,14**	**0,31**	**0,47**

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Tests with CANNABRIC

ASPECT AND MECHANICAL AND PHYSICAL QUALITIES	RESULTS:
Aspect (UNE 127.030/ 99):	**"The bricks have a homogeneous colour, with an evenly rough surface texture, which makes possible the adhesive strength of mortar and favours to render and plaster. No chipping off or replacement from material is to be observed, as well as no cracking."**
Measurement and wall-thickness (cm) (UNE-EN 772-16/ 2001):	**30**/ **14,5**/ **10,5** (solid brick, without holes)
Parallelism of the surfaces (maximum deviation)) (UNE-EN 772-20/ 2001):	**In the case of a measurement of 332 mm: 2,0 mm**
Orthogonality of the angles (maximum value of the tangent of angle deviations over 90º) (UNE 127.030/ 99):	**0,01**
Approximate density 28 days (determined in the factory):	**1,3 kg/ dm3**
Density after complete drying process (average value after UNE-EN 772-13/ 2001):	**1171 kg/ m3**
Mass after complete drying process (average value):	**5,35 kg**
Characterized compression strength (28 days), referred to the gross-section (UNE-EN 771-1/ 2001):	**13,00 kg/ cm2 (1,3 N/mm2)**
Medium compression strength (28 days), referred to the gross-section (UNE-EN 771-1/ 2001):	**14,00 kg/ cm2 (1,4 N/ mm2)**
Minimum compression strength (90 days), referred to the gross-section (UNE-EN 771-1/ 2001):	**15,00 kg/ cm2 (1,5 N/ mm2)**
Bending pressure strength (28 days) (UNE 83.305-86):	**6,10 kg/ cm2**
Resistance against mould and smells:	**Without signs.**
Fire resistance (during a load of 3kg/ cm2, corresponds to a large building of approximately 3 floors) (UNE 23,093-81):	**> RF 120** (minutes)

Thermal conductivity (UNE 92.202-89):	**0,16 kcal/ h·m·ºC (0,19 W/ m·K)**
Heat transition coefficients:	Load bearing wall rendered two-sided with lime mortar: **0,47 kcal/ h·ºC·m2 (0,56 W/ m2·K)** Inner wall plastered two-sided with lime mortar: **0,83 kcal/ h·ºC·m2 (0,99 W/ m2·K)**
Specific thermal coefficient:	**1,113 J/ g·K**
Heat accumulating capacity (thermal inertia):	**1303 kJ/ m3·K**
Water absorption (average value) (UNE-EN 772-11/ 2001):	**31,5 %**
Water suction (UNE 41.171/89):	**0,41g/ cm2 x 5 min**
Acoustic insulation (carrying outer wall rendered two-sided):	**54 dBA ***
Acoustic insulation (inner wall plastered two-sided):	**45 dBA ***

* calculated after NBE-CA-88

TABLE WITH THERMAL CHARACTERISTICS OF CANNABRIC	**Inner wall**		**Outer wall**
wall thickness (cm) **CANNABRIC** without render or plaster	10,5	14,5	30
heat transition coefficient ***U*** kcal/ h·ºC·m2 (W/ m2·K)	**1,09 (1,29)**	**0,86 (1,02)**	**0,48 (0,57)**
thermal resistance ***R*** kcal/ h·ºC·m2 (m2·K/ W)	**0,92 (0,78)**	**1,16 (0,98)**	**2,08 (1,75)**
wall thickness (cm) **CANNABRIC** with two-sided render or plaster	13	17	33
heat transition coefficient ***U*** kcal/ h·ºC·m2 (W/ m2·K)	**1,05 (1,25)**	**0,83 (0,99)**	**0,47 (0,56)**
thermal resistance ***R*** kcal/ h·ºC·m2 (m2·K/ W)	**0,95 (0,80)**	**1,20 (1,01)**	**2,13 (1,79)**
UNE 92.202-89 **thermal conductivity** kcal/ h·m·ºC (W/ m·K)	**0,16 (0,19)**		
heat accumulating capacity kJ/ m3·K	**1303**		

THERMAL PROPERTIES from various materials in the comparison:

material	specific thermal coefficient	density	heat accumulating capacity (thermal inertia)	thermal conductivity	heat transition coefficient with 30 cm wall thickness
	J/ g·K	kg/m³	kJ/ m³·K	W/ m·K	W/ m2·K
water	4,19	1000	4190	0,6	(1,49)
steel	0,46	7850	3611	58	
granite	0,83	2750	2282	3,5	3,85
marble	0,88	2400	2112	2,1	3,23
oak wood	2,38	850	2023	0,21	
slate	0,76	2650	2014	0,42	1,14
glass	0,83	2500	2075	1,4	
dry clay	0,93	2100	1953	0,95	2,04
steel concrete	0,81	2400	1944	1,63	2,86
ice	2,1	916	1923	0,59	1,47
concrete	0,84	2200	1848	1,4	2,63
plexiglas	1,47	1190	1749	0,19	
cement mortar	0,81	2000	1620	1,4	
dry earth (loam stone)	0,89	1800	1602	0,91	2,0
sandstone	0,71	2200	1567	1,3	2,5
gravel	0,92	1700	1564		
massif fired brick	0,83	1700	1411	0,96	2,08
lime mortar	0,87	1600	1392	0,87	
Cannabric *	1,113	1171	1303	0,19	0,57
light loam stone with straw	1	1200	1200	0,47	1,23
gypsum mortar	0,83	1440	1195	0,7	
dry sand	0,8	1400	1120	0,46	
pine wood	1,3	650	845	0,16	
Termoarcilla brick	0,79	910	719	0,29	0,83
corc panel	1,5	450	675	0,07	
cement bloc	0,84	750	630	1,15	2,33
straw ball	1,4	250	350	0,1	0,32
hemp hurds *	2,109	110	232	0,048	
insulation panels from wool	1,34	111	155	0,04	
glass wool	0,67	200	134	0,04	
poliurethane	1,59	24	38	0,03	
air	1,01	1,2	1,21	0,13	

* tested by Cannabric

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