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# **Tubes for Micropiles**

# Introduction

The continuous research for new foundation systems, cheap and adaptable for every situations, brought the Customers and Engineering Departments to be increasingly interested in the possibility offered by the micropiles technology. On their hand, the foundation companies developed new drilling and injection methods following the request of these new foundation technologies, meeting the recommendations for the regulations of construction of each country.

The micropiles we propose satisfy the strictest requirements of designers and executers, thanks to a long-time experience in the field of mechanical productions and to the support of Engineers and Technicians coming from the branch of special foundations.

*Raccordi Regonesi S.r.l.* developed a system of micropiles, in the form of certificate steel pipes with a big thickness, equipped with a multiple reinjection device able to improve considerably the load-bearing capacity of the micropile.



## Materials

The metal pipes used to realise a micropile exist in different quality of steel with chemical and mechanical characteristics that can be guaranteed with a certificate issued by approved control laboratory.

They mainly differentiate between new pipes in S235, S355 and N80 steel and reusable pipes in N80 steel that are examined and tested in workshop before their application.

Table **No. 1** shows the mechanical characteristics of the above said different quality of steel.

Description	Steel Type		
	Tensile strength min. (N/mm <sup>2</sup> )	Ultimate load min. (N/mm <sup>2</sup> )	Elongation at break min. (%)
S235	235	360	25
S355	355	500	21
N80	562	703	18,5

Table No. 1

## Stock and sizes

Some thousand tonnes of pipes are stocked, permanently, in the logistic areas of *Raccordi Regonesi S.r.l.* to guarantee a regular and rapid supply to Customers.

Table **No. 2** list the usual sizes of pipes for micropiles that are always available, excluding exceptional cases.

On request, any other type of pipes, with standard compliant sizes, can be produced in steelworks with delivery time varying from 6 to 8 weeks.

## Micropiles sizing

The micropiles sizing entails the definition of the supporting element characteristics (static sizing) and sealing length (geotechnical sizing).

The following table is based on approximate values of the DIN 4128 rule for which we took a security coefficient of  $f_s=1,75$  on the steel elasticity limit.

The sealing length must be calculated according to each type of soil and drilling diameter.

Diameter ø mm	Thickness mm	Weight Kg/ml	Section mm <sup>2</sup>	Service load with $f_s = 1,75$		
				S235	S355	N80
60,3	5	6,8	869	117	176	279
60,3	8	10,3	1.314	177	267	422
60,3	10	12,4	1.580	212	321	507
73	5,5	9,2	1.166	157	237	375
73	7,5	12,1	1.543	207	313	496
73	8	12,8	1.634	219	331	525
73	8,5	13,5	1.722	231	349	553
73	9	14,2	1.810	243	367	581
73	10	15,5	1.979	266	401	636
88,9	6,5	13,2	1.683	226	341	540
88,9	7,1	14,3	1.825	245	370	686
88,9	7,5	15,1	1.918	258	389	616
88,9	8	16	2.033	273	412	653
88,9	9	17,8	2.259	303	458	726
88,9	10	19,5	2.479	333	503	796
88,9	12,5	23,6	3.000	403	609	963
101,6	7,1	16,5	2.108	283	428	677
101,6	7,5	17,4	2.217	298	450	712
101,6	8	18,5	2.352	316	477	755
101,6	8,5	19,5	2.486	334	504	798
101,6	9	20,6	2.618	352	531	841
101,6	10	22,6	2.878	386	584	924
101,6	12,5	27,5	3.499	470	710	1.124
114,3	6,5	17,3	2.201	296	447	707
114,3	7,1	18,8	2.391	321	485	768
114,3	8	21	2.672	359	542	858
114,3	8,5	22,2	2.825	379	573	907
114,3	9	23,4	2.977	400	604	956
114,3	10	25,7	3.277	440	665	1.052
114,3	12,5	31,4	3.998	537	811	1.284
127	8	23,5	2.991	402	607	960
127	9	26,2	3.336	448	677	1.071
127	9,1	26,7	3.401	457	690	1.092
127	10	28,9	3.676	494	746	1.180
127	12,5	35,3	4.496	604	912	1.444
139,7	8	26	3.310	444	671	1.063
139,7	9	29	3.695	496	750	1.187
139,7	9,19	29,6	3.768	506	764	1.210
139,7	10	32	4.075	547	827	1.309
139,7	10,54	33,6	4.277	574	868	1.373
139,7	12,5	39,2	4.995	671	1.013	1.604
168,3	8	31,6	4.029	541	817	1.294
168,3	9	35,4	4.504	605	914	1.446
168,3	10	39	4.973	668	1.009	1.597
168,3	12,5	48	6.118	822	1.241	1.965
177,8	8	33,5	4.268	537	866	1.370
177,8	9	37,5	4.773	641	968	1.533
177,8	10	41,4	5.272	708	1.069	1.693
177,8	11	45,2	5.764	774	1.169	1.851
177,8	12,5	51	6.491	872	1.317	2.085
177,8	20	77,8	9.915	1.331	2.011	3.184
177,8	25	94,2	12.001	1.612	2.434	3.854
193,7	8	36,6	4.667	627	947	1.499
193,7	10	45,3	5.771	775	1.171	1.853
193,7	12,5	55,9	7.116	956	1.443	2.285
219,1	8	41,6	5.303	712	1.076	1.703
219,1	10	51,6	6.565	882	1.332	2.108
219,1	12,5	63,7	8.108	1.089	1.645	2.604
244,5	8	46,6	5.904	798	1.205	1.908
244,5	10	57,8	7.363	989	1.494	2.365
244,5	12,5	71,5	9.106	1.223	1.847	2.924

Table No. 2

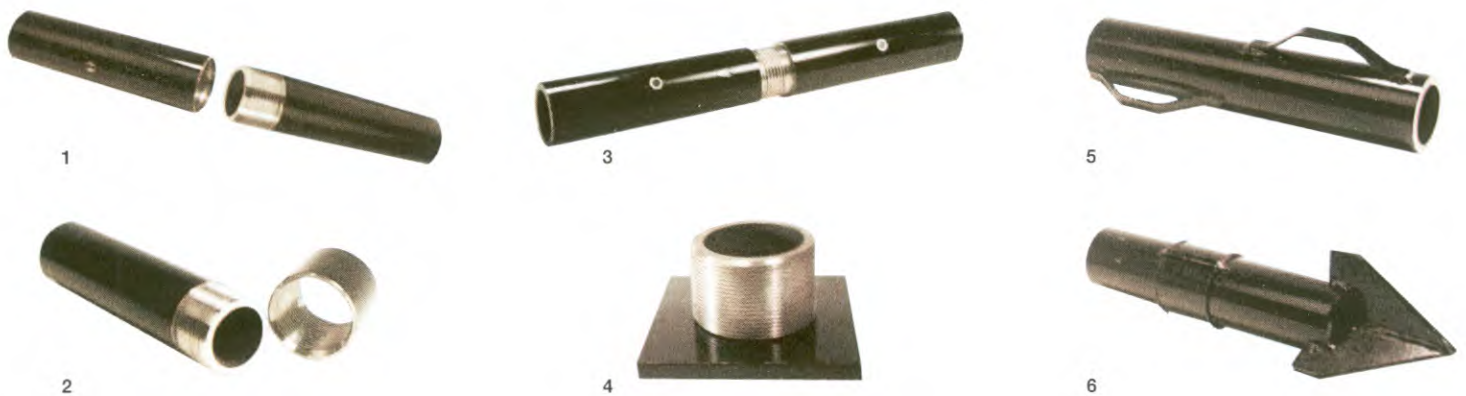
# Production of micropiles

The purpose of machining operations is to enable users to employ elements with lengths adaptable to the height available in the construction site (underpinning in basement, works in tunnel, etc.) and with the cheapest system.

Based on the indications of our Customers, the pipes are cut into different lengths and worked to be rolled into one through threads male/female or with a joint like external sleeves or internal nipples.

The threads we realise are trapezoidal, with a depth of 1,5 mm and a pitch of 3-4-5-6-7-8 or 11 threads per 1 inch (25,4 mm). Our standard production is 5 threads per inch.

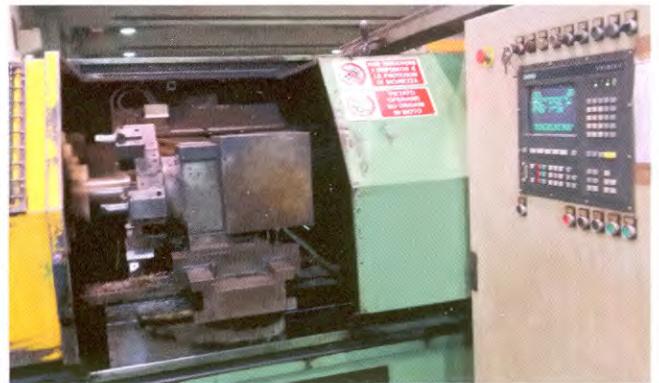
This large choice permits to optimise the length of the joint according to the type of stress of the micropiles (compression, traction, bending, inflection).



- 1 - Assembly male/female
- 2 - Assembly male/external sleeve
- 3 - Assembly female/internal nipple
- 4 - Head share-out
- 5 - Metallic centering devices
- 6 - Lost point



Detail of cut department.



Threading of pipes.



View of a department of Raccordi Regonesi S.r.l.



Set up of rubber sleeve.

## Setting and injection of micropiles

The setting of micropiles is made both into a wellbore drilling and directly with the pipe for micropile joint up to the puncher rotation head. In this last case, the micropile is equipped with a drilled lost point that allows the flow of the drilling fluid and the creation of an annular space sufficient to guarantee a cement covering from 2 to 3 mm (protection against corrosion).

The point, with 4 blades, are replaced by tricones when the micropile must be realised in compact soil formation or in the presence of hard stones.

Another setting possibility is to use a micropile as casing ODEX or TUBEX with a down the hole hammer and preferentially an eccentric blade.

This method has been in many occasions successfully used during the execution of umbrella-arch.

The micropile injection is made thanks to a couple of injection valves named M3 or MPIN that are inserted in the pipe thickness.

These patented valves, exclusively supplied by *Raccordi Regonesi S.r.l.*, operate as non-return valves to inject the soil several times.

This reinjection option improves the bearing capacity of the micropile and permits to optimise the total length of the seal.

M-PIN valves vary from M3 types for their composition, steel against aluminium, and for their solidity, the firsts have the rubber fastened by a central coiled pin, the seconds have the rubber linked to an external rubber ring.

M-PIN valves can be regulated with an opening of 5, 10 or 20 bar to prevent the opening during the direct drilling and they must be used in combination with a double packer that you have to put in correspondence with the couple of valves you want to inject.

The M3 valves instead can be injected simultaneously with an injection head screwed on the top of the micropile. They are particularly convenient, with the wellbore drilling system, in soils that don't require multiple reinjections.



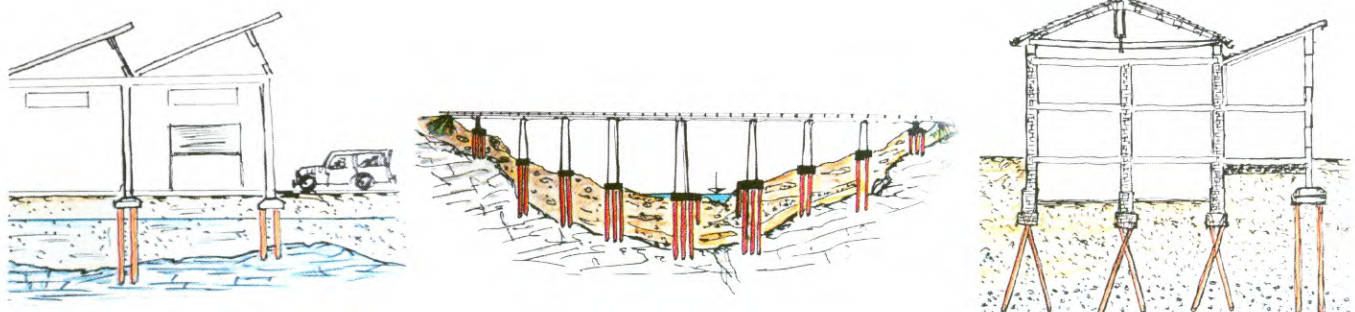
On the left M3 valve and on the right M-PIN valve.

## Some application possibilities

Thanks to their particularly economical joint possibilities, our micropiles are used in all cases where the construction site request the placement of small size pipes to be assembled it.

Other interesting applications can be considered in case of difficult access to the construction site, when the installation of a bulky drilling equipment is not possible and only a small and light drill can be installed.

More generally, our micropiles can be used, systematically, whenever the traction or compression stress on the surface must be transmitted to the level of subsoil compact layers.

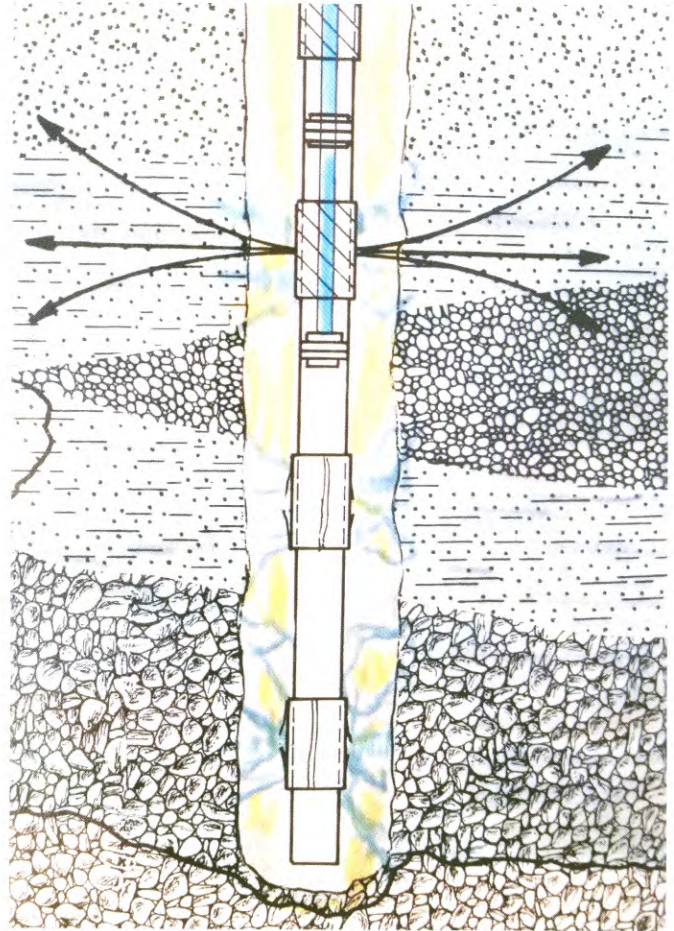


# Metallic Manchette pipe

## Steel pipe feature

- First choice pipe with tested quality certification in S235 steel.
- Longitudinal welding with inside tube scarfing.
- Available in 6 ml maximum length.

Nom. diam.	Ext. diam.	Thickness	Weight (Kg/m)
1" 1/2	48,3 mm	2,9 mm	3,3
2"	60,3 mm	3,2 mm	4,6
2" 1/2	76,1 mm	3,2 mm	5,9
3"	88,9 mm	3,2 mm	7,0
3" 1/2	101,6 mm	3,6 mm	9,0
4"	114,3 mm	3,6 mm	10,2



Rubber sleeve injection reproduction.

## Coupling feature

- Coupling in S235 steel with CYLINDRICAL GAZ thread following the norm UNI ISO 7/1.

Pipe nom. diam.	Coupling ext. diam.	Coupling length
1" 1/2	54,5 mm	48 mm
2"	66,3 mm	56 mm
2" 1/2	82,0 mm	65 mm
3"	95,0 mm	71 mm
3" 1/2	108,0 mm	75 mm
4"	122,0 mm	83 mm



Gaz threaded coupling.

# Metallic Manchette pipe

## Rubber sleeve feature

- Natural rubber of Superior Quality with a very high elasticity.
- Ultraviolet ray resistant.
- Hardness SHORE: 55
- Thickness: 3 mm
- Length:
  - up to 2" = 70 mm
  - from 2 to 4" = 75 mm
- Internal diameter: from 2 to 2,5 mm in relationship to the nominal diameter of the pipe.

## Pipe machining

- Thread
  - CYLINDRICAL GAZ thread following the norm UNI ISO 7/1
- Rubber sleeve
  - The standard spacing between the rubber sleeves is 1, 2 or 3 per metre or different on request.
  - The pipe drilling is made of 4 holes of 8 mm of diameter on 360°
  - The rubber sleeve cover the holes and it is laterally blocked by 2 metal rings of 4 mm of diameter and linked to the pipe by 4 welding points.
  - The external protection is made of 2 metal flat bar, 10 x 2 mm, in S235 steel welded to the both extremities.
- Thread protection
  - Thread finishing by anti-rust paint.



Example of anti-rust paint.

## Transport

- Packing per steel pallets following the security norms helping the unloading by forklift truck or crane.

# raccordi regonesi

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