

DESCRIPTION

JOINT PIPE, METHOD FOR MANUFACTURING THE SAME, METHOD FOR
DESIGNING THE SAME, JOINT PIPE-EQUIPPED STEEL PIPE, METHOD
FOR MANUFACTURING THE SAME, METHOD FOR DESIGNING THE SAME,
5 STEEL PIPE PILE, AND METHOD FOR INSTALLING STEEL PIPE PILE
Field

[0001] The present invention relates to a joint pipe for
use in joining steel pipes together and relates in
particular to a threaded or plug-in joint pipe for use in a
10 small-diameter steel pipe pile, a method for manufacturing
the same, a method for designing the same, a joint pipe-
equipped steel pipe, a method for manufacturing the same, a
method for designing the same, a steel pipe pile, and a
method for installing a steel pipe pile.

15 Background

[0002] Steel pipe piles have limitations on length for
manufacture and transport reasons, and a plurality of steel
pipe piles are required to be joined together in
installation sites. Although welding has conventionally
20 been used for this joining of the steel pipes, an
increasing number of mechanical joints have been used in
recent years from the viewpoint of a reduction in an
installation time and improvement in quality control. In
small-diameter (406.4 mm or less, for example) steel pipe
25 piles in particular, various mechanical joints have been
developed and used partly because equipment for welding can
be omitted.

[0003] Examples of the type of the mechanical joints
include a threaded one as disclosed in Patent Literature 1
30 and one achieving joining by inserting a shearing key as
disclosed in Patent Literature 2. Such a mechanical joint
includes a pair of joint pipes. The joint pipes are often
manufactured by cutting a short steel pipe separately from

a steel pipe to be the body of the pile and are welded to be mounted on the steel pipe as the pile body in a factory in advance. As in Patent Literature 1 and 2, the outer diameter of the joint pipes is generally made the same diameter as that of the pile body. This is because there are concerns that a joint part projects outwardly with respect to the pile to reduce installability and to reduce circumferential face friction force exhibited when used as the steel pipe pile. For the same reason, the range that does not affect the circumferential face friction force is limited to 9 mm or less in the field of road bridge foundations, for example.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Patent Application Laid-open No. H10-311028

Patent Literature 2: Japanese Patent Application Laid-open No. 2009-138382

Summary

Technical Problem

[0005] As described above, the joint pipe for use in the mechanical joint is manufactured separately from the steel pipe as the pile body and is then mounted on the steel pipe by a method of mounting such as welding. In this process, in the case of thin-walled structures such as small-diameter steel pipe piles in particular, the roundness of an end is likely to deteriorate, and misalignment may occur when the joint pipe and steel pipe are butted together. Here, "misalignment" refers to radial deviation occurring between the outer face shape of a joint pipe end and the outer face shape of a steel pipe end with the joint pipe and steel pipe are butted together or radial deviation occurring between the inner face shape of the joint pipe

end and the inner face shape of the steel pipe end. The presence of misalignment makes unevenness in the radial direction of joint end faces of the joint pipe and the steel pipe uneven in the circumferential direction. That is to say, a step in which the joint pipe projects outwardly occur in some parts in the circumferential direction, whereas a step in which the steel pipe projects outwardly in other parts. When such uneven steps occur on the joint end faces, stress transmission when used as a joint pipe-equipped steel pipe may be uneven in the circumferential direction. Thus, before welding the joint pipe and steel pipe together, the ends are required to be corrected (misalignment-corrected), which requires time and effort.

[0006] The present invention has been made in view of the above, and an object thereof is to provide a joint pipe that can omit correction of an end when mounted on a steel pipe, a method for manufacturing the same, a method for designing the same, a joint pipe-equipped steel pipe, a method for manufacturing the same, a method for designing the same, a steel pipe pile, and a method for installing a steel pipe pile.

Solution to Problem

[0007] A joint pipe according to one aspect of the present invention is a threaded or plug-in joint pipe mounted on an end of a steel pipe to join the steel pipe, and the joint pipe has: an outer diameter of a basal end to be joined to the steel pipe larger than an outer diameter of the steel pipe; an inner diameter of the basal end smaller than an inner diameter of the steel pipe; and a projection amount of the basal end from an outer circumferential face of the steel pipe of 9 mm or less with a pipe axis aligned with a pipe axis of the steel pipe.

[0008] A method according to one aspect of the present invention of manufacturing the joint pipe according to the present invention includes: selecting a steel pipe to be mounted with the joint pipe; selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard; and forming a joint fitting part in a part other than the basal end with the selected seamless steel pipe as a material of the joint pipe.

10 [0009] A method according to one aspect of the present invention of designing the joint pipe according to the present invention includes: selecting a steel pipe to be mounted with the joint pipe; selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard; and using the selected seamless steel pipe as a material of the joint pipe.

[0010] A joint pipe-equipped steel pipe according to one aspect of the present invention includes the joint pipe according to the present invention at both ends or one end of the steel pipe.

[0011] A method according to one aspect of the present invention for manufacturing a joint pipe-equipped steel pipe includes a step of mounting the joint pipe according to the present invention at both ends or one end of the steel pipe.

[0012] A method according to one aspect of the present invention of design designing the joint pipe-equipped steel pipe according to the present invention includes: selecting a steel pipe to be mounted with the joint pipe; selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard; and performing

design to provide the joint pipe with the selected seamless steel pipe as a material at both ends or one end of the steel pipe.

[0013] A steel pipe pile according to one aspect of the present invention includes: the joint pipe according to the present invention; and a plurality of steel pipes joined together with the joint pipe.

[0014] A method according to one aspect of the present invention of installing the steel pipe pile according to the present invention includes: erecting a steel pipe mounted with the joint pipe on one end in the ground; placing, on the steel pipe, another steel pipe mounted with another joint pipe on one end; and joining the joint pipe with the other joint pipe together.

Advantageous Effects of Invention

[0015] In the present invention, the outer diameter of the basal end to be joined to the steel pipe is made larger than the outer diameter of the steel pipe and the inner diameter of the basal end is made smaller than the inner diameter of the steel pipe, whereby joining can be achieved such that the basal end projects inwardly and outwardly with respect to the steel pipe in the entire circumference of the end faces of the steel pipe and the basal end, and uneven steps in the circumferential direction do not occur. Thus, uneven stress transmission in the circumferential direction does not occur when used as a joint pipe-equipped steel pipe, and correction of an end when mounted on the steel pipe can be omitted. The projection amount of the basal end from the outer circumferential face of the steel pipe is 9 mm or less with the pipe axis aligned with that of the steel pipe, thus not affecting the circumferential face friction of the pile.

Brief Description of Drawings

[0016] FIG. 1 is an illustrative diagram illustrating a joint pipe according to an embodiment of the present invention, being a sectional view of a state in which the joint pipe (an inner joint pipe) is mounted on a steel pipe.

FIG. 2 is a diagram of a state in which joint pipes (the inner joint pipe and an outer joint pipe) according to an embodiment of the invention are fit together.

Description of Embodiments

[0017] The following describes a joint pipe according to an embodiment of the present invention with an inner joint pipe for use in a threaded mechanical joint taken as an example with reference to FIG. 1. FIG. 1 is a sectional view of a state in which a joint pipe 1 (an inner joint pipe) and a steel pipe 3 are mounted on each other with their pipe axes aligned with each other (a joint pipe-equipped steel pipe 4). As illustrated in FIG. 1, the joint pipe 1 of the present embodiment is mounted on an end of the steel pipe 3 forming a pile body of a steel pipe pile to join the steel pipes 3 together, the joint pipe 1 having an outer diameter of a basal end 1a to be joined to the steel pipe 3 larger than an outer diameter of the steel pipe 3 and an inner diameter of the basal end 1a smaller than an inner diameter of the steel pipe 3. Note that in the drawing, 7 indicates baking metal, whereas 9 indicates a welding bead.

[0018] The outer diameter of the basal end 1a of the joint pipe 1 is made larger than the outer diameter of the steel pipe 3 and the inner diameter thereof is made smaller than the inner diameter of the steel pipe 3, whereby when the joint pipe 1 and the steel pipe 3 are butted against each other, the basal end 1a projects inwardly and outwardly with respect to the steel pipe 3 in the entire

circumferential direction. Thus, steps uneven in the circumferential direction do not occur in a butted part between the joint pipe 1 and the steel pipe 3, and stress transmission is achieved substantially evenly in the circumferential direction during use of the joint pipe-equipped steel pipe 4 (the steel pipe 3 equipped with the joint pipe 1). Consequently, the joint pipe 1 can be mounted on the steel pipe 3 without correcting the ends of the joint pipe 1 and the steel pipe 3, thus saving time and effort.

[0019] As described above, when the projection amount of the joint exceeds 9 mm, the circumferential face friction force may decrease. In this regard, as illustrated in FIG. 1, the joint pipe 1 of the present embodiment has a projection amount a (refer to the enlarged view of the part enclosed by the dashed circle in the drawing) of the basal end 1a outwardly from an outer circumferential face of the steel pipe 3 of 9 mm or less with a pipe axis aligned with that of the steel pipe 3 (refer to the dot-dashed line in the drawing).

[0020] As the joint pipe 1 described above, the inner joint pipe for use in the threaded mechanical joint has been described as an example; the same applies to an outer joint pipe. FIG. 2 illustrates a sectional view of a state in which the inner joint pipe 1 as the inner joint pipe and a joint pipe 5 as the outer joint pipe are fit together. As illustrated in FIG. 2, in the joint pipe 5 as well, the outer diameter of a basal end 5a is made larger than the outer diameter of the steel pipe 3 and the inner diameter thereof is made smaller than the inner diameter of the steel pipe 3, whereby the basal end 5a projects inwardly and outwardly with respect to the steel pipe 3 in the entire circumferential direction with the joint pipe 5 and

the steel pipe 3 mounted on each other with their pipe axes aligned with each other (a joint pipe-equipped steel pipe 11). Thus, as with the joint pipe 1 (the inner joint pipe), steps uneven in the circumferential direction do not occur in a butted part between the joint pipe 5 and the steel pipe 3, and stress transmission is achieved substantially evenly in the circumferential direction during use of the joint pipe-equipped steel pipe 11 (the steel pipe 3 equipped with the joint pipe 5). When the projection amount of the basal end 5a of the joint pipe 5 from the outer circumferential face of the steel pipe 3 is made 9 mm or less as with the joint pipe 1, the supporting force of the joint pipe-equipped steel pipe 11 during use will not be reduced.

[0021] Although FIG. 1 and FIG. 2 illustrate only one end of the joint pipe-equipped steel pipe 4 and the joint pipe-equipped steel pipe 11, the joint pipe-equipped steel pipe of the present invention is not limited to those with the joint pipe mounted only on one end but also includes those with the joint pipe mounted at both ends. Specifically, the present invention includes any of the following aspects: one including the joint pipe as the inner joint pipe at both ends or one end of the steel pipe, one including the joint pipe as the outer joint pipe at both ends or one end of the steel pipe, and one including the joint pipe as the inner joint pipe on one end of the steel pipe and the joint pipe as the outer joint pipe on the other end thereof.

[0022] The following describe a method for manufacturing the joint pipe 1. The method for manufacturing the joint pipe 1 of the present embodiment selects a steel pipe to be mounted with the joint pipe 1, selects a seamless steel pipe having a larger outer diameter and a smaller inner

diameter than standardized dimensions of the selected steel pipe 3 out of a standard, and forms a threaded part by cutting, for example, to form a joint fitting part 1b in a part other than the basal end 1a with the selected seamless steel pipe as a material of the joint pipe 1. The following specifically describes the method.

[0023] As described above, in the case of the threaded joint pipe, the joint pipe 1 is generally manufactured by cutting a short steel pipe separate from the steel pipe 3 as the pile body. Thus, the steel pipe 3 to be mounted with the joint pipe 1 is selected, and a short steel pipe having a larger outer diameter and a smaller inner diameter than the standardized dimensions (the outer diameter and the inner diameter) of the selected steel pipe 3 may be used as the material of the joint pipe 1.

[0024] When the difference in outer diameter between the short steel pipe and the steel pipe 3 forming the pile body is 18 mm or less, the projection amount a (refer to FIG. 1) when the joint pipe 1 is mounted on the steel pipe 3 is 9 mm or less, and thus the joint pipe 1 can be manufactured simply by forming the joint fitting part 1b (the threaded part) by cutting in the part other than the basal end 1a. When the difference in outer diameter between the short steel pipe and the steel pipe 3 exceeds 18 mm, it is necessary to cut the outer circumferential face until it becomes 18 mm or less, and thus the short steel pipe as the material is preferably slightly larger in outer diameter than the steel pipe as the pile body. In this regard, the present embodiment uses the seamless steel pipe as the short steel pipe to enable efficient manufacture of the joint pipe 1. The reason why the joint pipe 1 can efficiently be manufactured by using the seamless steel pipe will be described specifically in a method of design

described below.

[0025] The joint pipe-equipped steel pipe 4 can be manufactured by mounting the joint pipe 1 at both ends or one end of the steel pipe 3. A common method for mounting the joint pipe 1 on the steel pipe 3 is to place the steel pipe 3 on its side on a turning roller and to mount the joint pipe 1 on one end thereof by welding. In installing the steel pipe pile, it is important that the pipe axes of the steel pipe 3 and the joint pipe 1 are aligned with each other, and thus the joint pipe 1 and the steel pipe 3 are welded together with this in mind. The joint pipe 1 and the steel pipe 3 are different from each other in outer diameter, and thus it is recommended to rotate the turning roller with the joint pipe 1 temporarily mounted on the steel pipe 3 and to check whether the pipe axes of the joint pipe 1 and the steel pipe 3 are aligned with each other.

[0026] Once the pipe axes of the joint pipe 1 and the steel pipe 3 are aligned with each other as described above, the backing metal 7 is mounted on an inner face side of the steel pipe 3, and full welding is performed by full-circled penetration welding from an outer face side of the steel pipe 3. As described above, the joint pipe 1 of the present embodiment has a shape projecting outwardly with respect to the steel pipe 3 in the entire circumferential direction with the pipe axis aligned with that of the steel pipe 3, and thus there is no need to correct the end, making welding easy. Depending on the required strength of the joint pipe 1, fillet welding may be used instead of penetration welding.

[0027] The following describes a method for designing the joint pipe 1. The method for designing the joint pipe 1 of the present embodiment selects the steel pipe 3 to be

mounted with the joint pipe 1, selects a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe 3 out of a standard, and uses the selected seamless steel pipe as a material of the joint pipe 1. The following specifically describes this method.

[0028] For the steel pipe 3 forming the body of the steel pipe pile, electric resistance welded steel pipes, seamless steel pipes, plate-wound steel pipes, and the like are being used. The electric resistance welded pipes are generally used for the steel pipe pile, and thus the following describes a case in which an electric resistance welded steel pipe is used as the steel pipe 3 as an example. In the electric resistance welded steel pipes, the outer diameter and the plate thickness thereof are standardized as industrial products, and first, an electric resistance welded steel pipe forming the steel pipe 3 is selected out of the standardized dimensions of the electric resistance welded steel pipes being generally used as steel pipe piles based on the ground of an installation site and loading conditions.

[0029] Next, based on the standardized dimension (the outer diameter) of the selected electric resistance welded steel pipe, a short steel pipe as the material of the joint pipe 1 is selected. In this process, it is necessary to select one having a larger outer diameter than that of the steel pipe 3; when one with one size larger is selected within the standard of the same electric resistance welded steel pipe as the steel pipe 3, the outer diameter will significantly be large. In the joint pipe 1 of the present embodiment, the projection amount a described above (refer to FIG. 1) is required to be 9 mm or less, and when a steel pipe having a significantly larger outer diameter than that

of the steel pipe 3 is used as the material of the joint pipe 1, the amount of cutting increases, which is costly.

[0030] Given these circumstances, in this embodiment, a seamless steel pipe is used as the material of the joint pipe 1. Seamless steel pipes are also standardized as industrial products, and the standard of the seamless steel pipes corresponds to various sizes, and the standard includes sizes suitable as the joint pipe 1 of the present embodiment, that is, those with slightly larger outer diameters than the standardized dimensions of the electric resistance welded steel pipes described above. Table 1 lists the standard of the outside diameters of the electric resistance welded steel pipes for use in the steel pipe 3 and selects the seamless steel pipes appropriate as the joint pipe 1 to be mounted thereon out of the standard and lists them.

[0031]

Table 1

Steel pipe pile diameter (electric resistance welded steel pipe)	Joint outer diameter (seamless steel pipe)	Projection amount a	Remarks (projection amount $a \leq 9$ mm)
mm	mm	mm	
165.2	168.3	1.6	No need of cutting
190.7	193.7	1.5	No need of cutting
216.3	219.1	1.4	No need of cutting
267.4	273.1	2.9	No need of cutting
318.5	323.8	2.7	No need of cutting
355.4	365.1	4.9	No need of cutting
406.4	426.0	9.8	Only need to cut joint outer face by 1 mm

[0032] When the steel pipe 3 is an electric resistance welded steel pipe with an outer diameter of 165.2 mm, for

example, when the joint pipe 1 to be mounted thereon is also an electric resistance welded steel pipe, the electric resistance welded steel pipe with an outer diameter of 190.7 mm, which is one size larger, will be used. When the joint pipe 1 with an outer diameter of 190.7 mm is mounted on the steel pipe 3 with an outer diameter of 165.2 mm, the projection amount a exceeds 9 mm, and thus cutting to reduce the outer diameter of this electric resistance welded steel pipe is required, which takes processing costs.

[0033] On the other hand, when the joint pipe 1 is a seamless steel pipe, a seamless steel pipe with an outer diameter of 168.3 mm can be used. For the seamless steel pipe with an outer diameter of 168.3 mm, cutting to reduce the outer diameter is unnecessary, and the joint pipe 1 with a projection amount a of 9 mm or less can be manufactured simply by cutting the joint fitting part 1b.

[0034] When the steel pipe 3 is an electric resistance welded steel pipe with an outer diameter of 406.4 mm, a seamless steel pipe with an outer diameter of 426.0 mm will be used. Thus, to make the projection amount a 9 mm or less, cutting to reduce the outer diameter of the seamless steel pipe is required, but the amount of cutting is about 1 mm, and thus the processing is easy.

[0035] Those listed in Table 1 are the standard diameters on the standard, and ends of steel pipes actually manufactured vary in outer diameter, inner diameter, and wall thickness in the circumferential direction or become ovalized, thus causing parts that are larger than the standard diameters or parts that are smaller than the standard diameters. The diameter difference between the seamless steel pipe and electric resistance welded steel pipe described above is slight, and thus a case in which

the diameters of the electric resistance welded steel pipe and the seamless steel pipe deviate from the standard diameters was also examined.

[0036] The standard of the steel pipe piles specifies that the roundness defined by Equation (1) below should be 1.0% or less.

$$\text{Roundness} = (\text{maximum diameter} - \text{minimum diameter}) / \text{standard diameter} \times 100 \quad (1)$$

The maximum diameter and the minimum diameter in Equation (1) are those at a weld part of the steel pipe.

[0037] For example, when the roundness of the steel pipe 3 (the electric resistance welded steel pipe) and the joint pipe 1 (the seamless steel pipe) is 1% each, when a part of the steel pipe 3 with the largest diameter and a part of the joint pipe 1 with the smallest diameter are butted together, the steel pipe 3 may project outwardly with respect to the joint pipe 1 at this part. This can be prevented by aligning the directions of the respective maximum diameters in positioning before welding.

Consequently, it is sufficient to consider a case in which a part of the steel pipe 3 that is +0.5% of the standard diameter and a part of the joint pipe 1 that is -0.5% of the standard diameter are butted together. Table 2 lists the results.

[0038]

Table 2

Steel pipe pile diameter (electric resistance welded steel pipe)		Joint outer diameter (seamless steel pipe)		D - B
Standard diameter (A)	A × 1.005 (B)	Standard diameter (C)	C × 0.995 (D)	
mm	mm	mm	mm	mm
165.2	166.0	168.3	167.5	1.5
190.7	191.7	193.7	192.7	1.0
216.3	217.4	219.1	218.0	0.6
267.4	268.7	273.1	271.7	3.0
318.5	320.1	323.8	322.2	2.1
355.4	357.2	365.1	363.3	6.1
406.4	408.4	426.0	423.9	15.5

[0039] As listed in Table 2, comparing the value 1.005 times (+0.5%) the standard diameter of the electric resistance welded steel pipe listed in Table 1 and the value 0.995 times (-0.5%) the standard diameter of the seamless steel pipe with each other, the outside diameter of the seamless steel pipe is larger than the outer diameter of the electric resistance welded steel pipe in all the cases. As described above, when the seamless steel pipe is used as the material of the joint pipe 1, even when distortion occurs in the electric resistance welded steel pipe (the steel pipe 3) or the seamless steel pipe (the joint pipe 1), if it is on a permissible level under the standard, it should be considered that there is no obstacle to joining the joint pipe 1 and the steel pipe 3 together by welding.

[0040] In addition, the seamless steel pipe can freely be set in plate thickness, and thus it is easy to make the inner diameter smaller than the inner diameter of steel pipe 3 (the electric resistance welded steel pipe). The following describes this point with reference to Table 3.

[0041]

Table 3

Steel pipe pile (electric resistance welded steel pipe)			Joint (seamless steel pipe)	
Outer diameter	Plate thickness		Outer diameter	Manufacturing plate thickness
mm	mm	mm	mm	mm
165.2	5.6	7.1	168.3	4.0 to 40
190.7	7.0	8.2	193.7	5.1 to 45
216.3	8.2	12.7	219.1	6.0 to 52
267.4	9.3	12.7	273.1	6.0 to 65
318.5	7.9	12.7	323.8	6.4 to 65
355.4	7.9	12.7	365.1	7.9 to 64
406.4	9.5	12.7	426.0	9.0 to 60

[0042] Table 3 lists general plate thicknesses when using the electric resistance welded steel pipes with the respective outer diameters listed in Table 1 for the steel pipe pile (the steel pipe 3) and manufacturing plate thickness ranges of the seamless steel pipes with the respective outer diameters listed in Table 1. For example, in Table 3, the inner diameter of the electric resistance welded steel pipe with an outer diameter of 165.2 mm and a plate thickness of 5.6 mm is 154 mm, whereas the inner diameter of the electric resistance welded steel pipe with an outer diameter of 165.2 mm and a plate thickness of 7.1 mm is 151 mm. On the other hand, the manufacturing plate thickness range of the seamless steel pipe with an outer diameter of 168.3 mm is 4.0 mm or more and 40 mm or less. Thus, the plate thickness may be set to be within this manufacturing plate thickness range to make the inner diameter less than 154 mm or 151 mm.

[0043] The joint pipe-equipped steel pipe 4 can be designed by performing design to provide the joint pipe 1 described above at both ends or one end of the steel pipe 3. Specifically, the joint pipe-equipped steel pipe 4 of

the present embodiment can be designed by selecting the steel pipe 3 to be mounted with the joint pipe 1, selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe 3 out of a standard, and performing design to provide the joint pipe 1 with the selected seamless steel pipe as a material at both ends or one end of the steel pipe 3.

[0044] The method for manufacturing and the method for designing the joint pipe and the method for manufacturing and the method for designing the joint pipe-equipped steel pipe described above have described the joint pipe 1 as the inner joint pipe and the joint pipe-equipped steel pipe 4 including the joint pipe 1 as examples; the same applies to the joint pipe 5 as the outer joint pipe and the joint pipe-equipped steel pipe 11 including the joint pipe 5.

[0045] As described above, the joint pipe 1 of the present embodiment has an outer diameter of the basal end 1a of the joint pipe 1 larger than the outer diameter of the steel pipe 3 and an inner diameter of the basal end 1a smaller than the inner diameter of the steel pipe 3, and thus time and effort to correct the ends of the joint pipe 1 and the steel pipe 3 when mounted on the steel pipe 3 can be omitted. In addition, the projection amount from the outer circumferential face of the steel pipe 3 is 9 mm or less with the pipe axis aligned with that of the steel pipe 3, and thus certain supporting force can be exhibited when used for the steel pipe pile. In particular, when the joint pipe 1 of the joint pipe-equipped steel pipe 4 and the joint pipe 5 of the joint pipe-equipped steel pipe 11 are joined together to make a steel pipe pile, the projection amount is 9 mm or less for both, and thus certain supporting force can surely be exhibited, which is

more suitable. In particular, when the present invention is applied as the steel pipe pile with an outer diameter of 406.4 mm or less, which is generally called "small diameter," time and effort of manufacturing can
5 significantly be saved, thus reducing manufacturing costs. Furthermore, the steel pipe pile with an outer diameter of 406.4 mm or less is very often a rotational penetration pile, and thus the present invention, which less affects the circumferential face friction of the pile, is more
10 suitable. Furthermore, by using the seamless steel pipe as the material of the joint pipe 1, the amount of cutting when cutting the material can be reduced to a minimum, thus reducing manufacturing costs.

[0046] In the embodiment described above, the threaded
15 joint pipe in which the joint pipes are fit together by means of a screw formed in the joint fitting part has been described as an example; the joint pipe, the method of manufacture, and the method of design of the present invention are not limited to this example. For example,
20 the joint pipe may be of a plug-in type, in which the inner joint pipe is inserted into the outer joint pipe, whereby a protrusion formed on an outer circumferential face of the inner joint pipe and a recess formed on an inner circumferential face of the outer joint pipe engage with
25 each other, and the joint pipes are fit together.

[0047] In the embodiment described above, the joint fitting parts 1b and 5b of the joint pipes 1 and 5, respectively, are formed by cutting; the invention is not limited to this example. Other known or unknown techniques
30 may be used to form the joint fitting parts 1b and 5b, and the effect of the present invention can be obtained in such cases as well. However, the joint pipe of the present invention is not limited to those with the joint fitting

part machined afterward on the steel pipe as the material as described above; for example, the joint fitting part may be manufactured at the same time by casting or using a 3D printer.

5 [0048] In the method for manufacturing the joint pipe-equipped steel pipe described above, an example of mounting the joint pipes 1 and 5 on the end of steel pipe 3 by welding has been described; the present invention is not limited to this example. Other methods of mounting are
10 acceptable so long as they can surely join the joint pipes 1 and 5 to the steel pipe 3 with the pipe axis aligned with that of the steel pipe 3, withstand various loads exerted during installation and during use, and exhibit supporting force as the steel pipe pile.

15 [0049] In the embodiment described above, the joint pipe and the joint pipe-equipped steel pipe mounted with the joint pipe have been described; the steel pipe pile can be formed by coupling joint pipes of a plurality of joint pipe-equipped steel pipes to each other at installation
20 sites or the like. That is to say, the steel pipe pile includes the joint pipe described in the embodiment described above and a plurality of steel pipes joined together with this joint pipe.

[0050] When installing the steel pipe pile described
25 above, with a steel pipe mounted with the joint pipe on one end (a joint pipe-equipped steel pipe) erected in the ground, on this steel pipe, another steel pipe mounted with the joint pipe on one end (another joint pipe-equipped steel pipe) may be placed, and the joint pipes may be
30 joined together.

Industrial Applicability

[0051] The present invention is suitably used for joint pipes for use in joining steel pipes together and in

particular threaded or plug-in joint pipes for use in small-diameter steel pipe piles.

Reference Signs List

	[0052]	1	JOINT PIPE (INNER JOINT PIPE)
5		1a	BASAL END
		1b	JOINT FITTING PART
		3	STEEL PIPE
		4	JOINT PIPE-EQUIPPED STEEL PIPE
		5	JOINT PIPE (OUTER JOINT PIPE)
10		5a	BASAL END
		5b	JOINT FITTING PART
		7	BACKING METAL
		9	WELDING BEAD
		11	JOINT PIPE-EQUIPPED STEEL PIPE
15			

CLAIMS

1. A joint pipe that is a threaded or plug-in joint pipe mounted on an end of a steel pipe to join the steel pipe, the joint pipe has:

- 5 an outer diameter of a basal end to be joined to the steel pipe larger than an outer diameter of the steel pipe;
an inner diameter of the basal end smaller than an inner diameter of the steel pipe; and
a projection amount of the basal end from an outer
10 circumferential face of the steel pipe of 9 mm or less with a pipe axis aligned with a pipe axis of the steel pipe.

2. A method of manufacturing the joint pipe according to claim 1, the method comprising:

- 15 selecting a steel pipe to be mounted with the joint pipe;
selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard;
20 and
forming a joint fitting part in a part other than the basal end with the selected seamless steel pipe as a material of the joint pipe.

25 3. A method of designing the joint pipe according to claim 1, the method comprising:

- selecting a steel pipe to be mounted with the joint pipe;
selecting a seamless steel pipe having a larger outer
30 diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard;
and
using the selected seamless steel pipe as a material

of the joint pipe.

4. A joint pipe-equipped steel pipe comprising the joint pipe according to claim 1 at both ends or one end of the
5 steel pipe.

5. A method for manufacturing a joint pipe-equipped steel pipe comprising a step of mounting the joint pipe according to claim 1 at both ends or one end of the steel pipe.

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6. A method of design designing the joint pipe-equipped steel pipe according to claim 4, the method comprising:
selecting a steel pipe to be mounted with the joint pipe;

15 selecting a seamless steel pipe having a larger outer diameter and a smaller inner diameter than standardized dimensions of the selected steel pipe out of a standard;
and

performing design to provide the joint pipe with the
20 selected seamless steel pipe as a material at both ends or one end of the steel pipe.

7. A steel pipe pile comprising:
the joint pipe according to claim 1; and
25 a plurality of steel pipes joined together with the joint pipe.

8. A method of installing the steel pipe pile according to claim 7, the method comprising:

30 erecting a steel pipe mounted with the joint pipe on one end in the ground;

placing, on the steel pipe, another steel pipe mounted with another joint pipe on one end; and

joining the joint pipe with the other joint pipe
together.