Title of the Invention: Conical transition piece
Abstract Title: Conical transition piece between the tower and jacket of a wind turbine

A transition piece for efficiently transferring structural loads from a tower of a wind turbine generator to its foundation consists of a conical central body 3 connected to a top plate 2, middle plate 5, lower plate 7, further connected by shear and gusset plates 4, and a series of legs 6, that connects to a foundation structure. The tower joint ring 1 may have a filleted edge 2 for reduction of stress concentration.

Fig.1
Fig. 2
Conical Transition Piece

The invention relates to a structural entity for transferring loads between a jacket and a Tower of a wind turbine.

Off-shore wind-turbine support structures consist of a subsea jacket with battered legs that are anchored by means of piles to the sea-bed and a Tower to which the turbine is attached. The Tower and jacket are connected by means of a transition piece.

Current methods for connecting the Jacket to the Tower consist of a variety of structural forms that consist of welded steel plates, braces, castings and tubular members. The Transition Piece must transfer bending, compressive, tensile and torque forces without attracting high stress concentrations at key structural joints. Such constraints become critical when a jacket is installed in deep waters and a large diameter wind turbine with a tall Tower must be used. For resisting the higher inertia loads, the jacket base must be relatively large and reduce in plan size to the Tower diameter above sea level, while attracting minimal stress concentration at key structural joints. Present Transition Pieces are heavy and complex structural forms that attract high stress concentration at key structural joints, thereby limiting their fatigue life.

It is an aim of the present invention to provide a solution of a type that is not made in a conventional manner and that will overcome the limitations mentioned above.

An alternative solution for a Transition Piece that provides a structural connection between a wind-turbine Tower and a support jacket is the main aim of this invention.

Accordingly, this invention provides for a Conical Transition Piece, characterized in that an inverted central cone has an upper flange for attachment to a wind-turbine Tower and a lower assembly of welded
plates for connection to the jacket battered legs. The assembly of welded plates consists of gusset plates and shear plates that join the battered legs to the cone. The shear plates are bounded by end-plates which are also welded to the cone and provide torsional rigidity to the assembly.

Such structural arrangement enables efficient transfer of loads from Tower to battered legs within the foot-print of the Tower base. This feature leads to significant reduction of stress concentration at the tower bottom to annular ring region, due to the elimination of radial protruding load bearing members outside the Tower foot-print.

In one preferred embodiment of a Conical Transition Piece, an annular ring which has a flange with bolt holes for connecting to the Tower base, forms part of the upper surface of the cone. The cone’s external surface has a series of radial gusset plates that transfers loads from the cone to the middle plate. The middle plate is connected to the top of the battered legs. The cone lower extremity has radial shear plates which are connected to both battered legs and a lower annular plate. Thus, load transfer is made from the Tower base to the annular ring, via the cone and assembly of plates and into the jacket battered legs.

One embodiment of the invention will be described solely by way of example and with reference to the accompanying drawings in which:

**Fig. 1** shows a general external view of a Conical Transition Piece;

**Fig. 2** shows a vertical sectional view of a Conical Transition Piece;

**Fig. 3** shows a mid-plan sectional view of a Conical Transition Piece;

**Fig. 4** shows a bottom-plan sectional view of a Conical Transition Piece;
**Fig. 1** shows a Conical Transition Piece assembly. The assembly consists of Tower joint ring (1) with filleted transition ring (2) connected to cone (3) and gusset plates (4) which, in turn, are connected to middle plate (5). Middle plate (5) is connected to battered legs (6) which are connected to lower plate (7).

**Fig. 2** shows a vertical sectional view of the Conical Transition Piece assembly. The view shows the connection of the cone (3) to battered legs (6) via gusset plates (4) and shear plates (8) into battered legs (6).

**Fig. 3** shows a mid-plan sectional view of a Conical Transition Piece assembly. The view shows the cone (3) with gusset plates (4) connected to mid plate (5).

**Fig. 4** shows a lower plan sectional view of a Conical Transition Piece assembly. The view shows the cone (3) connected to battered legs (6) via shear plate (8) and lower plate (7).
Claims

1. Conical Transition Piece assembly consisting of at least one Tower joint ring (1) with cone (3) characterised in that the cone (3) is of a size that enables partial placement of the mid plate (5) with attached battered legs (6) within the footprint of the Tower joint ring (1).

2. Conical Transition Piece assembly according to claim 1 characterised in that any number of battered legs (6) can be attached to the mid plate (5) and shear plates (8).

3. Conical Transition Piece assembly according to claims 1&2 characterised in that a load path between Tower joint ring (1) and battered legs (6) is made via cone (3) to gusset plate (4) and shear plates (8) which are bounded and connected to mid plate (5) and bottom plate (7).

4. Conical Transition Piece assembly according to claims 1 to 3 characterised in that the Tower joint ring (1) has a filleted edge (2) for reduction of stress concentration due to load transfer into gusset plate (4) and cone (3).

5. Conical Transition Piece assembly according to claims 1 to 4 characterised in that the mid plate (5) and bottom plate (7) are connected to battered legs (6) for transfer of torsional loads.
**Application No:** GB1214362.4  
**Examiner:** John Twin  
**Claims searched:** 1 to 5  
**Date of search:** 24 February 2014

**Patents Act 1977: Search Report under Section 17**

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(Repower Systems) - see fig.5 |

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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

- E02B; F03D

The following online and other databases have been used in the preparation of this search report:

- EPODOC, TXTE, WPI

**International Classification:**

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