Claims

1. A hydroelectric turbine recovery system for recovering a base mounted hydroelectric turbine, the system comprising a frame having an opening permitting the frame to be advanced around the turbine via the opening; characterised in that the frame comprises a plurality of couplers engagable with the base.

2. A recovery system according to claim 1 in which the base comprises corresponding couplers engagable with the plurality of couplers on the frame.

3. A recovery system according to claim 2 in which the couplers on the frame and the couplers on the base are arranged to be brought into registration through vertical movement relative to one another.

4. A recovery system according to any of claims 1 to 3 in which the frame is substantially U shaped.

5. A recovery system according to any of claims 1 to 4 in which the frame comprises one or more guides to assist in aligning the frame with the base.

6. A recovery system according to claim 5 in which the one or more guides are immovably fixed in position.

7. A recovery system according to claim 5 or 6 in which at least one of the guides comprises a buffer positioned to engage the turbine and/or base when the frame is substantially aligned with the base in order to arrest further displacement of the fame relative to the base.

8. A recovery system according to claim 7 in which the buffer comprising a cross member extending between a pair of opposed arms of the frame.

9. A recovery system according to claim 7 or 8 in which the buffer is resiliently deformable in order to prevent damage to the turbine and/or base on contact therewith.

10. A recovery system according to any of claims 2 to 9 in which the couplers on the frame each comprise a hydraulically actuated lifting tool and the couplers on the base each comprise a corresponding dock within which the lifting tool is reversibly lockable.

11. A recovery system according to any preceding claim in which the couplers on the frame and/or base are secured by mountings which permit limited displacement of the couplers.

12. A recovery system according to any preceding claim comprising one or more sensors operable to detect contact and correct alignment between the frame and the turbine and/or base.

13. A recovery system according to any preceding claim comprising one or more imaging sensors.

14. A method of recovering a base mounted hydroelectric turbine from the seabed, the method comprising the steps of:
lowering a recovery frame having an opening from a deployment vessel into a position laterally adjacent the base mounted turbine;
advancing the frame around the turbine via the opening;
coupling the frame to the base; and
lifting the base and turbine off the seabed as a single unit.

15. A method according to claim 14 comprising, prior to the step of coupling the frame to the base, substantially vertically lowering the frame into engagement with the base.

16. A method according to claim 14 or 15 comprising the step of:
arresting the lateral displacement of the frame, when substantially aligned with the base, through contact with the turbine of a buffer mounted to the frame.

17. A method according to any of claims 14 to 16 comprising, in the step of coupling the frame to the base, inserting a plurality of couplers on the frame into a corresponding plurality of couplers on the base.

18. A method according to any of claims 14 to 17 comprising the step of performing the method in a running tide; and positioning the recovery frame down tide of the turbine prior to lowering the frame into position laterally adjacent the turbine.

19. A method according to any of claims 14 to 18 comprising the step of providing power to the recovery frame via a power cable connected between the deployment vessel and the frame; and managing the cable by positioning the cable in the water down tide of the frame.

Claims

1. A hydroelectric turbine recovery system (10) for recovering a base mounted hydroelectric turbine, the system comprising a base (B); a turbine (T) mounted to the base; and a frame (12) having an opening (22) permitting the frame to be advanced around the base mounted turbine via the opening; characterised in that the frame comprises a plurality of couplers (28) engagable with the base such as to permit the turbine and base to be recovered as a single unit.

2. A recovery system according to claim 1 in which the base comprises corresponding couplers (30) engagable with the plurality of couplers on the frame.

3. A recovery system according to claim 2 in which the couplers on the frame and the couplers on the base are arranged to be brought into registration through vertical movement relative to one another.

4. A recovery system according to any of claims 1 to 3 in which the frame is substantially U shaped.

5. A recovery system according to any of claims 1 to 4 in which the frame comprises one or more guides (20, 26) to assist in aligning the frame with the base.

6. A recovery system according to claim 5 in which the one or more guides are immovably fixed in position.

7. A recovery system according to claim 5 or 6 in which at least one of the guides comprises a buffer (26) positioned to engage the turbine and/or base when the frame is substantially aligned with the base in order to arrest further displacement of the fame relative to the base.

8. A recovery system according to claim 7 in which the buffer comprising a cross member (26) extending between a pair of opposed arms (16) of the frame.

9. A recovery system according to claim 7 or 8 in which the buffer is resiliently deformable in order to prevent damage to the turbine and/or base on contact therewith.

10. A recovery system according to any of claims 2 to 9 in which the couplers on the frame each comprise a hydraulically actuated lifting tool and the couplers on the base each comprise a corresponding dock within which the lifting tool is reversibly lockable.

11. A recovery system according to any preceding claim in which the couplers on the frame and/or base are secured by mountings which permit limited displacement of the couplers.

12. A recovery system according to any preceding claim comprising one or more sensors operable to detect contact and correct alignment between the frame and the turbine and/or base.

13. A recovery system according to any preceding claim comprising one or more imaging sensors.

14. A method of recovering a base (B) mounted hydroelectric turbine (T) from the seabed, the method comprising the steps of:

lowering a recovery frame (12) having an opening (22) from a deployment vessel into a position laterally adjacent the base mounted turbine;

advancing the frame around the turbine via the opening;

coupling the frame to the base; and

lifting the base and turbine off the seabed as a single unit.

15. A method according to claim 14 comprising, prior to the step of coupling the frame to the base, substantially vertically lowering the frame into engagement with the base.

16. A method according to claim 14 or 15 comprising the step of:

arresting the lateral displacement of the frame, when substantially aligned with the base, through contact with the turbine of a buffer (26) mounted to the frame.

17. A method according to any of claims 14 to 16 comprising, in the step of coupling the frame to the base, inserting a plurality of couplers (28) on the frame into a corresponding plurality of couplers (30) on the base.

18. A method according to any of claims 14 to 17 comprising the step of performing the method in a running tide; and positioning the recovery frame down tide of the turbine prior to lowering the frame into position laterally adjacent the turbine.

19. A method according to any of claims 14 to 18 comprising the step of providing power to the recovery frame via a power cable connected between the deployment vessel and the frame; and managing the cable by positioning the cable in the water down tide of the frame.