



British Horological Institute

## Certificate in the Repair, Restoration and Conservation of Clocks / Watches

### Unit 4 : Final Grade Part I : The Practical Repair of Clocks

#### Data Sheet – Designing a Recoil Escapement

**The examination requires candidates to design and make the pallets for a recoil escapement; the escape wheel and a plate with two studs are provided. These instructions, based on material in the Distance Learning Course, apply the principles of escapement construction to a specific example. They are provided for your guidance. The actual number of teeth, centre distance and number of teeth embraced by the pallets, applicable to your exercise, should be determined from the examination paper and the actual materials provided. You are required to submit your drawing or a copy of your drawing with the completed escapement.**

Example of escapement design using the following data:-

Tip diameter of escape wheel	32.7mm
Root diameter of escape wheel	26.5mm
Number of teeth in escape wheel	36
Number of teeth embraced by pallets	7½
Impulse angle of pallets	4°
Allowance for drop (including ½° tooth tip thickness)	1°

Escapement Construction:-

1. Draw the line of centres, tip circle and root circle of the escape wheel, label the centre of the wheel O.
2. *In this instance the escape wheel has 36 teeth; therefore each tooth and space occupies an angle, measured from the wheel centre, of  $360^\circ \div 36 = 10^\circ$ . The pallets embrace 7½ tooth spaces and thus the angle embraced by the pallets is  $7\frac{1}{2} \times 10^\circ = 75^\circ$ . The action of the escapement is to be symmetrical about the line of centres and therefore half of this angle will be marked out at each side of the centre line joining the axes of the escape wheel and pallets.*

Draw the construction lines OA, OB at an angle of  $37.5^\circ$  on each side of the line of centres of the escape wheel and pallets; label the points A and B.

3. *The axis of the pallets, in this example, is to lie at the point of intersection of the tangents to the tip circle at points A and B.*

Draw tangents at A and B to intersect at P the axis of the pallets. Label the point O; the distance between centres is thus OP.

4. *The action of the escape wheel takes place as the escape wheel turns through half a tooth space. In this example, therefore, the escape wheel turns  $5^\circ$ ; drop is  $1^\circ$  (including tooth tip thickness). Impulse will therefore be delivered as the wheel turns through  $5^\circ - 1^\circ = 4^\circ$ . Half of this angle,  $2^\circ$ , must occur before each of the lines, OA and OB and half afterwards.*

Draw the lines OC and OD from the escape wheel centre at  $2^\circ$  on either side of OA, and the lines OE and OF similarly on either side of OB. Label the points C, D, E, F.

5. *The escape wheel is to turn clockwise. Assuming that a tooth has just dropped on to the entrance pallet its leading edge will lie at C, the "drop point" of the entrance pallet. The discharging corner of the exit pallet will lie at F. Since drop of  $1^\circ$  has occurred, the leading edge of the tooth which has just escaped will be  $1^\circ$  after the point F and the trailing edge  $\frac{1}{2}^\circ$  after the point F.*

Draw the wheel teeth.

6. *The pallets move through  $4^\circ$  during impulse; the discharging corner G, for the entry pallet, will thus lie on an arc drawn using the centre P through the point D.*

Draw a line through the point P at an angle of  $4^\circ$  to PA, measured anti-clockwise, and then draw an arc with centre P, radius PD to intersect this line at G.

*Similarly for the exit pallet, the drop point will lie on an arc drawn using centre P through the point E.*

Draw a line through the point P at an angle of  $4^\circ$  to PB, measured anti-clockwise, and then draw an arc with centre P, radius PE to intersect this line at H.

7. Join the discharging corner with the drop point for each pallet with, in this instance, an arc radius 12mm to give the impulse faces. The remaining portion of the outline of the pallets can now be drawn – the decoration beyond the exit pallet gives a more balanced appearance to the pallets.