TRAINING ON ANTAM STANDARD CODE
For TESTING OF KNAPSACK MISTERS CUM DUSTERS

Theory 18: Waterproof test

(Test Code Section IV(9) and D- 11 of Annex D)

2nd Training of Trainers on ANTAM Codes
16 - 28 October2016, Nanjing China

Power tiller in operation in puddling

water proof test facility

OECD STANDARD Code FOR THE OFFICIAL TESTING OF AGRICULTURAL AND FORESTRY TRACTOR PERFORMANCE Code2-July-2012

- The waterproofing test is applied to wheeled or track-laying tractors to be used in the paddy field for pudding.
- The primary purpose is to verify the waterproofing functions of the wheel axles, the brake assembly and the clutch assembly.
- Verification can however be extended at the request of the manufacturer to other parts of tractors such as engine sump, hydraulic/transmission case and self starter that could be damaged by water penetration.
- The tractor is classed as “waterproof tractor,” if after the test described below, there is no water penetration into axle, brake, clutch system or any other part submitted to the verification

Test bed

OECD Test Code 2

The test shall be conducted in a cistern. The tractor shall be set on the roller bed (or on a similar device) where the tractor remains safely fixed during the test. For two-wheel-drive tractors the front axle shall be driven by external means at the same equivalent ground speed as the rear axle.

Water level

OECD Test Code 2

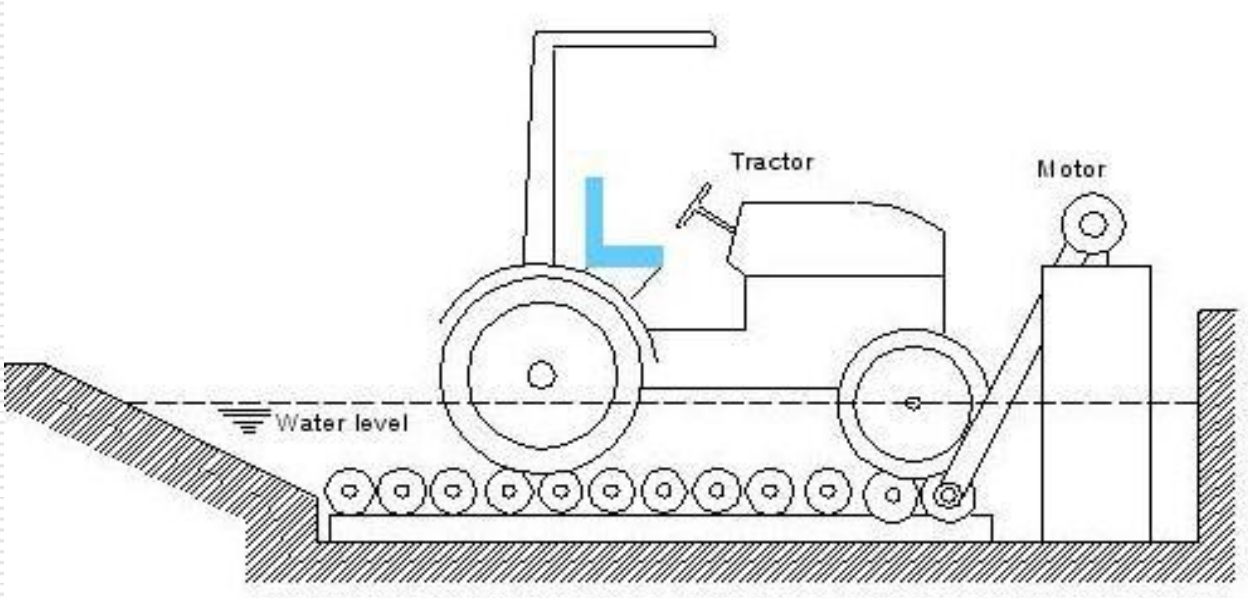
The water level shall be adjusted to the height of the centre line of the front axle (wheeled tractor) or the driven sprockets (track-laying tractor) with the tractor in a horizontal position, as if driving on a road. However, if the centre line is higher than 400 mm above ground level (in accordance with ISO 4251-1:2005) the water level shall only be raised to 400 mm above the ground level.

Potable water shall be used in the cistern.

The same tyres as described under “2.6 Tyres and track width specifications” in the specimen test report shall be fitted for the test.

Water level

OECD Test Code 2



Test procedures

OECD Test Code 2

- General provisions
- The tractor shall be in the gear giving the nominal forward speed nearest to 6km/h and operated continuously at rated speed for 2 hours. The tractor shall then (immediately) be removed from the cistern and any excess water shall be wiped off the outside of the axles, clutch and brake assemblies with a rag. The tractor shall be left in a place free from rain or snow for at least 12 hours before being finally checked.
- The axles (including centre pivot), clutch housing, the brake assembly and any other part also optionally submitted for test shall then be disassembled and any evidence of water penetration into them shall be stated in the test report.

Success of test

OECD Test Code 2

- Unsuccessful test
- If the test fails, the manufacturer may ask for a repeat test of the same tractor but only once. The tractor when re-tested, shall be equipped with the same components after the seals have been changed and/or re-fixed in conformity with manufacturing specifications.

Checking water ingress

- Non-lubricating parts (e.g. „dry“ brakes)
- “Dry” type clutch housings, and similar “dry” tractor components, shall be checked visually inside for water ingress as indicated by actual water or rust from oxidation.
- Oiled parts
- For the tractor’s parts running in oil and under test, the oil in the housing shall be checked using one or more of the following alternative methods:
- Visual method: Distinct emulsification and/or colour change of the oil shall be regarded as proof of water ingress

Checking water ingress

OECD Test Code 2

- Crackling method : When water ingress is not visually distinct, the presence of water in the lubricant shall be checked by putting a heated electric soldering iron into the oil. The presence of water crackling shall be regarded as waterproofing failure; conversely, no crackling shall be regarded as waterproofing or;
- Other physical (e.g. centrifugation) or chemical (e.g. Karl-Fisher) standards to check if there is water in the oil are accepted.

WATERPROOF TEST

ANTAM 001 2016

The waterproof test is conducted to determine the effectiveness of the seals of the power tiller when operated under lowland condition.

The power tiller shall be fitted with **puddling wheels** as per recommendation of manufacturer and with **no implement** attached.

The power tiller is classed as “waterproof power tiller,” if after the test described below, there is no soil and water penetration into axle, brake and clutch system (4.9.1 OECD Code 2).

Test Bed and soil condition

ANTAM 001 2016

The test shall be conducted in a testing water bath/soil bin filled with a **mixture of soil and water** with a ratio of 1:3 by volume (TIS 1350-1996).

The soil shall contain 10-30% sand, 10-30% silt and 40-80% clay by weight while **potable water** shall be used (TIS 1350-1996).

Soil Mixture /Water Level :

The soil mixture /water level shall be adjusted to the height of the **centre line of the wheel axle** with the power tiller in a horizontal position.

The power tiller shall be installed and fixed on a stand for free rotation of puddling wheels.

Test Procedures
ANTAM 001 2016

- The power tiller shall be in the gear giving the nominal forward speed nearest to 6 kmph (4.9.3.1 OECD Code 2) and operated continuously at rated engine speed for 5 hours.
- If there will be leakage of oil from the axle shaft to the mixture of soil and water prior to the completion of test, then the test shall be terminated.
- The power tiller shall then be removed from the testing bath and be cleaned.
- The power tiller shall be left in a place free from rain or snow for at least 12 hours before being finally checked (4.9.3.1 OECD Code 2).

Success in test

ANTAM 001 2016

- The axle, clutch housing, the brake assembly shall then be disassembled and any evidence of soil and water solution penetration into them shall be stated in the test report.
- **Unsuccessful Test**
- If the test fails, the manufacturer may ask for a repeat test of the same power tiller but only once. The power tiller when re-tested shall be equipped with the same components after the seals have been changed and/or re-fixed in conformity with manufacturer's specifications (4.9.3.1 OECD Code 2).

Checking water/mud ingress

ANTAM 001 2016

The oil in the housing (e. g. transmission box, engine sump) shall be checked using one or more of the following alternative methods :

Visual method: Distinct emulsification and/or colour change of the oil shall be regarded as proof of water ingress or;

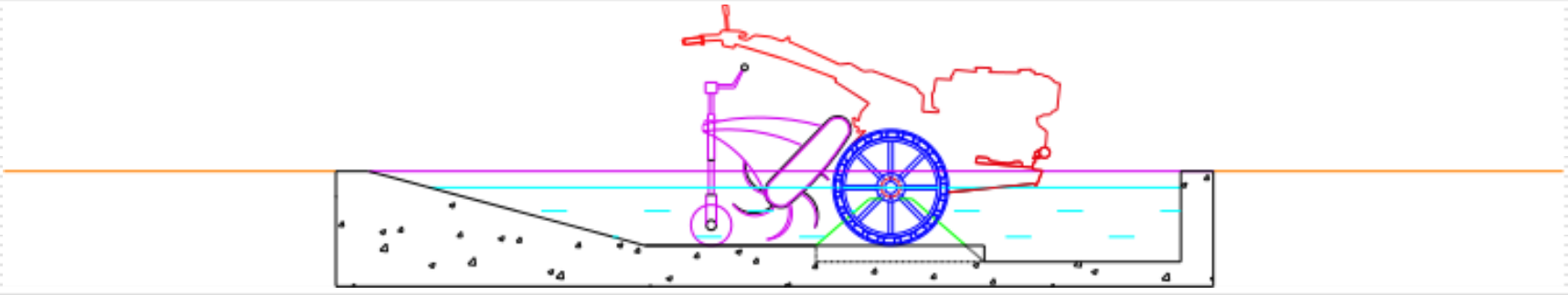
Crackling method: When water ingress is not visually distinct, the presence of water in the lubricant shall be checked by putting a heated electric soldering iron into the oil. The presence of water crackling shall be regarded as waterproof failure; conversely, no crackling shall be regarded as waterproofing; or

Other methods: Other physical (e.g. centrifugation) or chemical (e.g. Karl-Fisher) standards to check if there is water in the oil are accepted.

BHUTAN STANDARD (Draft)
National Standard for power tillers

- Water proof
- Water should not enter the transmission and axle case when the wheels are submerged
- 20cm for 2 hours in continuous operation

Power tiller waterproof testing arrangement



Conducting water proof test

- The water ingress into dry and wet areas are to be ascertained by different methods.
- For dry areas like dry clutch, brake, the visual inspection is to be done after dismantling
- (Many older tractors having expanding drum type brake are not water proof)
- Wet areas are to be checked by analysis of oil and also by dismantling

Dismantling power tiller for ascertaining water proofness

- The critical areas for failure are the rotary seals in the axle, and rotary shaft.
- The seals fail due to abrasion by soil.
- If the mud has physical contact with the seal, the mud can be drawn into the seal running area thus abrading the seal and also the journal.
- The seals have a dual function of sealing the lubricant from leakage and also preventing the water from outside from ingress. Means are to be employed to prevent failure of the seal. Oil seal protectors are provided in the seal group.
- Under field condition, weeds are wrapped on the shaft and if not cleared, they will lead to failure of seal

- Water can also enter through breathers and other openings , provided to prevent pressure build up.
- It should be under stood that a power tiller may fail water proof test by leakage of engine oil or gearbox oil and also by leakage of outside water into the gearbox.- implying need for two way sealing of rotary seals
- Water may enter through other components like gear shift rails, gear actuation mechanism, steering actuators

- When a power tiller is dismantled, the seals gaskets, O rings and other sealing elements that are meant for onetime use are to be replaced (as per manufacturers recommendation)
- The repeat of the water proof test can be done once

http://www.knowledgebank.irri.org/step-by-step-production/pre-planting/land-preparation

Pilipino design of Turtle Power tiller

Light weight IRRI design Power tiller

After all, the proof of the pudding is in the eating.