FLR-CropDrying
HIGH PERFORMANCE VENTILATION SYSTEMS

Installation Manual

Drive-on Floors

Contents

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Introduction

1. Flach & Le-Roy Ltd are Ventilation Engineers serving the arable farming industry. The company was formed in 1993 by Richard Flach and Owen Le-Roy who have each served this industry for over 25 years.
2. Flach and Le-Roy Ltd provides ventilation systems design services to main turnkey providers of crop-drying and storage facilities as well as direct to the UK and overseas farming communities. Our design philosophy is based upon practical experience and sound knowledge of the latest advances in ventilation technology.
3. Our production capability includes the manufacture, supply and installation of timber–formed floors, walls and air ducts for drying and storing grain and vegetables. We also supply fans, gas heaters and ancillary equipment enabling us to provide whole crop-drying and storage installations within the UK and abroad.
4. Flach & Le-Roy's reputation is founded on design know-how, quality workmanship, use of high-quality timber and equipment and the ability to design and install high performance crop-drying systems in both brand-new facilities and in existing building conversions.
5. At Flach & Le-Roy we are wholly committed to the success of our current and future customers. We listen carefully to our customers; try to understand their needs and work hard to make their crop-drying decisions as well-informed as possible. Put simply, at Flach & Le-Roy we put our customers' success ahead of all other business considerations.
6. As of January 2010 Flach & Le-Roy Ltd has designed and delivered over 1000 installations to its UK and overseas customers.

General Product Description

7. **Drive-on Ventilated Floors**. Flach & Le-Roy Drive-on ventilated floors (Fig 1) provide today's hardworking farms with a flexible, reliable and efficient crop-drying and storage system with the capacity to handle the throughput of today's modern harvesting machinery with ease.

Fig 1

Drive-on Ventilated Floor

8. Unlike constant flow drying machinery Drive-on floors can be self-installed by farm staff thereby reducing the overall cost to the farmer. The Company provides palletised parts clearly marked for ease of assembly and our self-install package includes a training day, stand-by support and tool-hire services if required. A full installation service is also available and our teams of fully trained professionals have many years experience which enables us to install flooring quickly and efficiently to a high standard of finish (Fig. 2).

9. Flach & Le-Roy floors are designed to a high specification using top-grade hardwood and softwood boards in short lengths for ease of maintenance. Our

hardwood top boards are manufactured from selected Keruing timber which we purchase kiln-dried prior to moulding in order to minimize shrinkage. This treatment significantly reduces the risk of a ventilation mesh becoming detached during service. The timber used in our optional softwood top boards and in all our bearers is slow growing Baltic, Russian or Scandinavian timber giving excellent wear characteristics.

Fig 2

Installing the Drive-on Floor

10. The timber bearers are kiln-dried beams, wider at the main bearer for added stability and strength. Floor loading is permitted up to 5 tons axle weight per pneumatic tyre giving a wide tolerance for a variety of farm vehicles. The floor is of modular design enabling the bearers to be adjusted on-site to allow for variations in the concrete floor level; this is of particular benefit when converting an existing building to a drying and storage facility.
11. The floor design is a result of Flach & Le-Roy's continuous development over several years and is optimised to maintain the required airflow and restrict airspeed to less than 10 m/s (2000 ft/min). Plywood sealing strips are inserted at

the board ends to provide a positive, long-lasting air seal to minimise air-loss along the length of the floor. These strips are designed to avoid any tendency to split or shrink as is often the case with seal blocks.

12. Galvanised steel ventilation meshes are installed at close, even intervals (Fig. 3, which makes the floor ideal for drying difficult crops such as grass seed at shallow depths. The meshes lie below the board surface to minimise the risk of damage from farm machinery and are wide enough to provide a good overall floor-free area without being too wide to risk pressure damage from wheels. Flach & Le-Roy floors can be supplied with or without mesh inserts making them suitable for use with a wide range of crops.

Fig 3

Galvanised Steel Ventilation Meshes

13. A Flach & Le-Roy floor can be viewed as a long-term valuable asset. In uncertain times if the farming policy should change a Flach & Le-Roy floor can be lifted, if required, offering a saleable asset and freeing an intact building for an alternative use.

14. **Main Air Ducts**. Flach & Le-Roy Main Air Ducts are manufactured using the same high-grade timber described above and are supplied with optional hardwood or softwood frames and/or hardwood or softwood ply cladding (Fig 4 & 5). Our ducts range from a height of 2.44 metres to 4.88 metres high and can be made

available to suit timber floors, above and level floor laterals, and boxes. If required building dividers can be provided to connect from the duct walkway to the roof of the building and tailor-made designs, including wide-end sections and walkway-mounted plenum chambers to house the fans are our speciality.

Fig 4

Central Main Air Duct with Plenum Chamber

Fig 5

Internal Structure of Main Air Duct

15. All Flach & Le-Roy air ducts are carefully designed and constructed to ensure the maximum flexibility for directed airflow and minimal air leakage joints and fittings ensuring little or no loss of efficiency in drying performance. Outlets with easy to use sliding doors are spaced between each frame providing maximum drying flexibility (Fig 6).

Fig 6

Outlets with Sliding Doors

Fig 7

Letterbox Main Air Duct

16. **Letterbox Main Air Ducts**. FLR Letterbox main air ducts (Fig 7) are manufactured using the same high-grade timber as in our floor products and supplied with optional hardwood or softwood frames and superior Indonesian and Malaysian hardwood ply.

17. The markets for onions and potatoes demand the highest quality products and this can only be achieved consistently with controlled in-store ventilation of the crop.

18. Letterbox main air duct systems can provide precise monitoring of both air and crop temperature and humidity to enable the accurate control of high output modulating heaters, fans and air control louvres thus ensuring optimum storage conditions.

19. Ducts can be supplied with remotely controlled outlets operated from walkway level or ground level. The duct side-ply can be extended to the roofline with timber framing to form a walkway-mounted air-mix and fan plenum. The fans can be mounted either above or below the duct walkway or on the end of the duct in a traditional fan house. We can also supply motorised or spring-operated recirculation doors and louvres, insulated intake louvres and covers, insulated exhaust louvres and fridge systems and support.

20. **<u>Self-Shedding Walling</u>**. FLR walling uses stress-graded timber and cladding options in hardwood or softwood ply are available. Standard wall storage heights range from 2.44 metres up to 3.66 metres. We can also supply one-off designs to greater heights to suit customer requirements.
21. The walling is designed for maximum strength to accommodate level or surcharge fill depending on need.
22. Double-sided walling is available to enable the farmer to build a crop divider. The self-shedding wall design is both cost-effective and easy to clean and maintain.
23. Some farmers may wish to opt for DIY installation to cut cost. We calculate and supply everything from timber, ply-cladding, steel anchor brackets with expansion bolts or resin anchors to the hire of specialist equipment and one day's training to get you started.

Fig 8

Self Shedding Walls

Fig 9

Self Shedding Walls

24. **<u>Axial and Centrifugal Flow Fans. Control Panel and Gas Burners.</u>** In general, ventilating cereals in bulk with 100 cfm/ton at the correct relative humidity level will reduce the moisture content by up to 0.5% over 24 hours. Typically, therefore, a 30kw centrifugal fan (Fig 10) will be suitable for drying a 300 ton batch of grain when specified at the correct operating pressure.

Fig 10

Centrifugal Fans

25. Historically fan drying rate has been dependent on a number a factors, i.e. air temperature and relative humidity, seed size and initial crop moisture content. However, in order to provide today's farms with the capability to handle the throughput of modern harvesting machinery FLR also takes account of the customer's anticipated floor-loading rates and ultimate crop depth when recommending fan sizes.

Fig11

Twin Axial Flow Fans

26. We supply and install a wide of range of centrifugal and axial-flow fans (Fig 11) to meet system requirements and these range between low-pressure axial units used for drying vegetable crops to high-pressure centrifugal and multi-stage axial fans used for drying cereals and seed crops. All our fans can be delivered complete with wire guards, silencers, mounting feet, bellmouth entries and dampers as required.

27. Our automatic control panels (Fig 12) can be supplied complete with door interlocking isolators, fan contactors, fan selector switches, remote stop terminals, louvre controls, fan-run hours-meters, time clocks, thermostatically controlled panel anti-condensation heater and interlocked burner electrical supply terminals or sockets. In general all circuits are protected by modern circuit-breaker technology.

Fig 12

Control Panel & Fan Room

28. Our fan controllers provide either intermittent fan operation which sense either/both air temperature and/or air relative humidity and control the drying fan within pre-set limits or we can supply an upgraded version which also provides 24-hour continuous operation and controls a fully modulated gas heater (Fig 13).

29. We have three ranges of gas heaters: (1) basic mobile units which can supply from 150k BTU/hr to 900k BTU/hr, (2) industrial specification permanent burners which can supply from 250k BTU/hr to 4.0 m BTU/hr and (3) industrial specification positive pressure burners which maintain the high levels of safety associated with permanent burners but without imposing any pressure differential on the main fan. Our industrial specification burners are supplied as standard complete with electronic temperature/humidity controller, galvanised steel casings, pressure regulator, auto-pilot start, twin main flame solenoids, modulating valve, power failure protection, fan failure protection, overheat thermostat and flame failure protection.

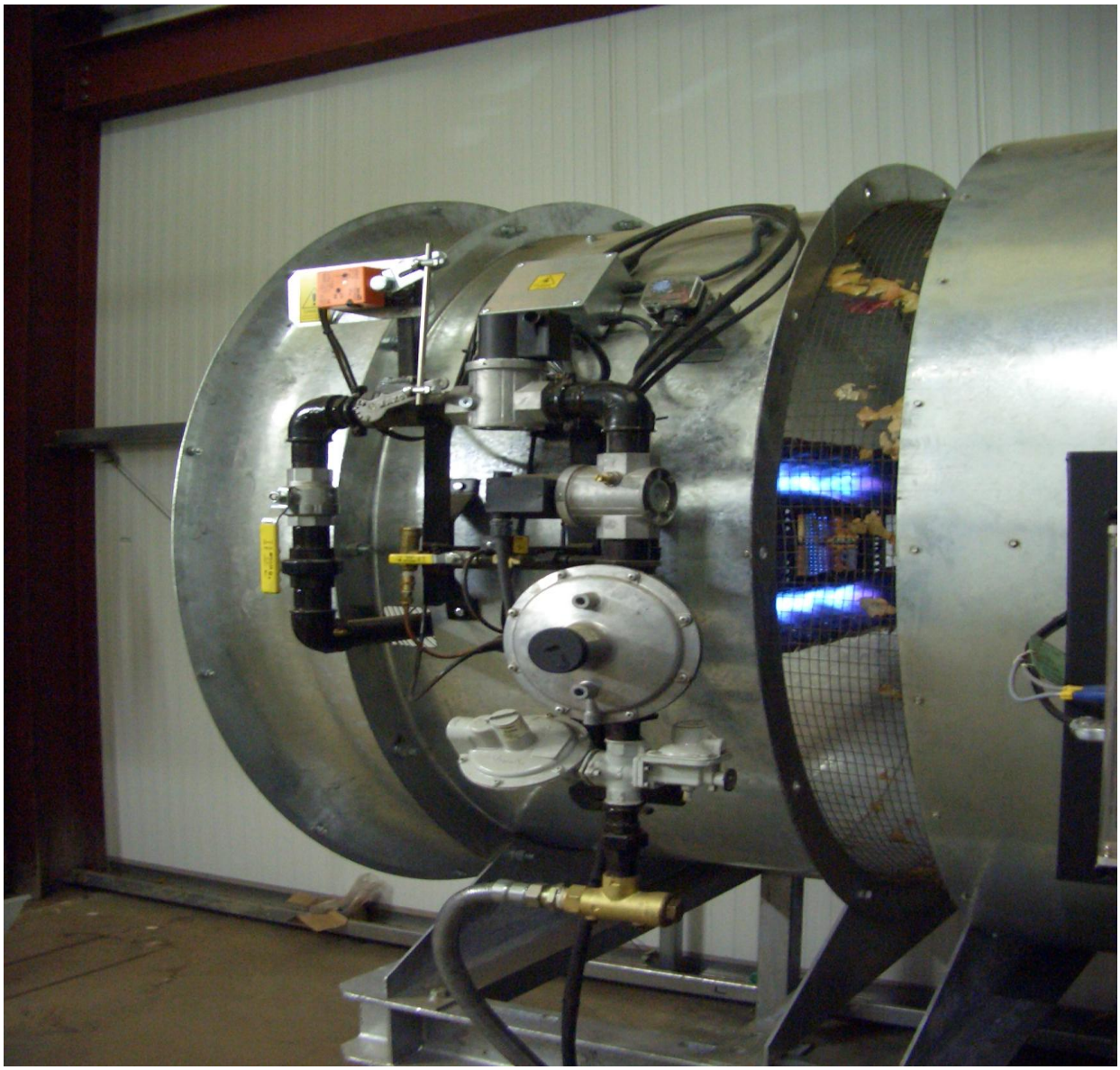

Fig 13

Fully Modulated Gas Burners

30. **Health and Safety** The following safety guidelines are provided for employees and contractors working on behalf of Flach & Le-Roy and recommended to self-install customers and their staff engaged in the installation of Flach & Le-Roy crop-drying products. Any special safety issues that need to be brought to the installing erectors' notice should be communicated by the customer prior to each day's work commencing, e.g. if a grain dust hazard will be present during grain filling and loading the supervising erector must be made aware of any planned activity in the vicinity of the ongoing installation.
31. **General.** Safety helmets will be worn by installation erectors in hard hat areas on the site.
32. Scissor lift and/or Scaffold towers are to be used when working at height above 2.44 metres.
33. Offload timber from the delivery vehicle using a forklift for which a valid licence is held.
34. Place the offloaded timber in close proximity to its final position and stack it clear of the ground on timber battens.
35. Adhere to the installation sequence as portrayed in this manual unless the directed otherwise by the supervising erector.
36. This guide has been concerned with establishing conditions of crop moisture content and temperature in bulk drying and storage units, so that the required degree of stability is established which renders crops 'safe' for the appropriate storage period. Of even greater importance is the necessity for this function to be carried out safely by those who operate or have reason to visit your installations.
37. By contrast with some agricultural activities - which by their very nature can be described as 'risky' - it would appear that grain drying units could reasonably described as 'passive'. In spite of this, records show that in England and Wales between 1973 and 1994 no fewer than 62 deaths were associated with grain drying and storage units. This unacceptably high level arises in part because many activities in grain drying and storage units are carried out by one person working alone. Seldom is anyone in a supervisory capacity present to stop or correct unsafe practices or to render first aid when an accident occurs. This factor emphasises the importance of thorough training regarding the dangers inherent in the working environment and in the functions performed. Most of

the accidents which have occurred in grain drying and storage units in recent years can be attributed to the following causes:

i. Respiratory disorders

ii. Electrocution.

iii. Structural failures

iv. Submersion in flowing grain.

v. Falls

vi. Submersion in bridged grain.

vii. Accidents with machinery.

38. The majority of bulk drying and storage facilities to which this guide relates are not equipped with pits and silos/hoppers which empty under the influence of gravity. However awareness of the risk of entrapment in flowing or bridged grain is important for all grain store operators.

39. The hazards against which the operators of bulk grain drying and storage units must be safeguarded include :

40. Grain dust - the Control of Substances Hazardous to Health Regulations 1988 (the COSHH Regulations) attribute a Maximum Exposure Limit (MEL) to grain dust. This reflects the very hazardous nature of the dust which may contain bacteria, fungi and pesticide residues. A particular problem with grain dust is that many of the particles are very small, enabling them to penetrate deep into the structure of the lungs where they can cause lasting damage and a number of respiratory disorders. The MEL value attributed to grain dust under the COSHH Regulations is 10mg/m3 for an 8-hour time weighted average. There is also a 10 minute maximum exposure value of 30mg/m3. These values must never be exceeded and steps must be taken to ensure that exposure values are reduced below these values ‘so far as is reasonably practical’. Hence as part of your COSHH Assessment you will need to assess the levels of dust to which operators are exposed, in your store.

41. One operational benefit of Flach and Le-Roy drive-on floors, by contrast with above floor ducted systems is that workers do not need to spend time installing/recovering ducts in a dusty environment, while the store is being filled/emptied. However dense dust is created when loading/unloading drive-on floors. Enclosing the operator in a tractor/loader cab which is equipped with a

properly maintained forced air filtration unit is an example of an 'engineering control' which complies with the requirements of the COSHH Regulations. A record sheet should be completed and attached to your COSHH Assessment to verify that air filters have been changed in accordance with the manufacturer's instructions. As a last resort respiratory protection equipment can be used to provide the necessary protection. Professional guidance should be sought on the selection of suitable RPE which should take into account the hazardous nature and small particle size of grain dust.

42. Structural failures-the number of accidents resulting from structural failures within grain stores which have been designed for the purpose, is small. However there is considerable risk associated with using general purpose buildings for crop storage when the stored product transmits loads to structures which were not designed to withstand them. British Standard 5502: 1987 Design of Buildings and Structures for Agriculture provides recommendations, guidance and technical data for appropriately qualified persons concerned with building design and construction. It also contains information regarding loads and pressures exerted by stored agricultural products.
43. Load bearing equipment manufactured by Flach & Le-Roy is designed by professional structural engineers using appropriate factors of safety. Regretfully accidents have occurred when structures built by others without the necessary skills have failed. The areas of greatest concern are:
44. Failures arising from the rerection of second hand equipment. For example, we do not advise re-erection of second-hand main air ducts without professional guidance. Proper understanding of the stresses involved when they are loaded on one side only is essential to ensure the appropriate fixing to concrete floors.
45. Structures must only be subjected to the loads which they were designed to withstand. Retaining structures which have been designed to be level loaded must not be surcharged. The maximum safe loading height should be indicated on the manufacturer's installation sign.

46. Falls - the increased height of many grain drying and storage installations gives emphasis to the need to keep stairways and catwalks, including associated hand and guard-rails, in good condition. Many falls involve the use of ladders, so

frequently used routes within bulk grain drying and storage units should be equipped with fixed ladders or staircases, not unsecured ladders. Deaths occurred on two occasions when ladders being used to gain access to a silo and a grain vehicle slipped, resulting in fatal falls. When working with ladders remember that:

1) A second person standing at the foot of a ladder to prevent it slipping is only effective with ladders less than about 6m long.

2) Ladders should extend at least 1m above the landing place or the highest rung in use, unless there is a suitable handhold to provide equivalent support.

3) Only use ladders at their most stable angle. A slope of four units 'up' to each one from the base (75° from horizontal on firm and level ground) is recommended.

47. Accidents with machinery - fortunately many of the items of machinery which have caused accidents/fatalities are not used in bulk grain drying and storage units. However they are not hazard free:

1) Accidents have occurred when automatic fan controllers have started fans unexpectedly. Hence before working on fans ensure that power supplies are isolated.

2) Problems have arisen when fans have started while operators have been working within main air ducts. When this happens it can be impossible to open exit doors as a result of the force upon them caused by the air pressure. Hence the provision of an isolator to stop the fan from within the duct is essential. Mammals, including man, will not experience difficulty in breathing at the pressures found within air ducts, (after all it doesn't harm the mice!)

3) Access doors into main air ducts are often located adjacent to fans. This emphasises the need for both fan inlets and outlets to be adequately guarded.

48. Loading vehicles, including telescopic materials handlers, should only be operated by suitably qualified drivers. Employers should ensure that operation of such vehicles is restricted to authorised operators and that authorisation is not given unless the operator is adequately trained or experienced. In the case of drivers employed in this task since 1st April 1989, adequate training is a statutory requirement.

49. Electrocution - the Management of Health and Safety at Work Regulations 1992 require employers to make a suitable and sufficient assessment of the risks to the health of employees. Such an assessment should include risks arising from the use of electrical equipment. The particular legal requirements relating to the use and maintenance of electrical equipment are contained in the Electricity at Work Regulations 1998. These Regulations require certain safety objectives to be met, e.g. inspection and testing. However they do not stipulate the frequency of this requirement. This is to enable qualified electricians to select a schedule appropriate to the risk and avoids the need to have precautions imposed that may not be relevant to a particular work activity.

50. An incident in which a worker was electrocuted in a grain store illustrates the need for compliance with the Regulations. The worker supported himself on a roof truss as he leaned over a silo to see if it was full. Unknown to him the truss was 'live'. When he touched the silo it provided a path to earth and he was electrocuted. Inspection revealed that when the lights in the building were switched on, faults in the wiring caused parts of the metal framework of the building to become live. The electrical system incorporated an earth leakage circuit-breaker which failed to perform its function because the earth wire had broken away from its earthing connector. It is recommended that such safety devices are tested at least once a month and any malfunction investigated and rectified urgently, before the circuit is used again.

51. Submersion in flowing crops - although the risk of submersion in flowing crops is unlikely to be a hazard encountered by operators of the bulk drying and storage units to which this guide relates, the hazard is so great that reference to it is justified.

52. Submersion in bridged grain - grain which has been inadequately dried may lose its free flowing characteristics as a result of the development of moulds and fungi, leading to caking. When bins and towers containing such grain are emptied by gravity, bridging can occur resulting in the formation of 'caverns' beneath the bridged crop.

    i. Accidents have occurred in two ways. The weight of operators who climb into bins to investigate the reason for the interruption of grain flow may be sufficient to cause the bridge to collapse; this can cause burial in the crop, resulting in suffocation. Secondly, operators entering bins and silos containing bridged grain at ground level may

cause the grain to collapse on them, again resulting in suffocation. Such accidents could be avoided by ensuring that crops are properly dried and cooled prior to storage so that deterioration resulting in bridging does not occur.

ii. Should bridging occur in spite of precautions, assistance must be obtained. Attempts must only be made to clear bridges from outside of the bin by operators wearing safety harnesses appropriately anchored. It may be possible to make the bridge collapse with the use of a long pole or by dropping heavy weights onto the surface of the crop. Equipment used in this operation should be secured by ropes to the top of the bin to facilitate their retrieval and eliminate the temptation to enter bins to recover them.

Drive-On Floor Installation.

Floor Parts List

1. Main bearer
2. Intermediate bearer
3. Floor end stop ply
4. Door seat flashing (steel)
5. Tunnel Arris board
6. Top board
7. Starter board
8. Door seat board
9. Cleaning out doors
10. Top board nails
11. Mesh nail
12. Ply Strips
13. Hardwood 32 x 41mm
14. Cleaning out door handle
15. Meshes
16. T1 Duct rail & Upstand (Transition Duct only)
17. T2 vertical support (Transition Duct only)
18. T4 divider ply (Transition Duct only)
19. T5 cover ply (Transition Duct only)
20. Joining strip (Transition Duct only)
21. Nails 90 mm & 45 mm (Transition Duct only)
22. Ply plates (Transition Duct only)
23. Corner flashing (Transition Duct only)
24. Angle Flashing 80 x 30mm & Steel Seat 8 x 60mm

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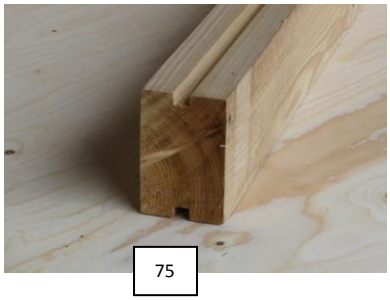
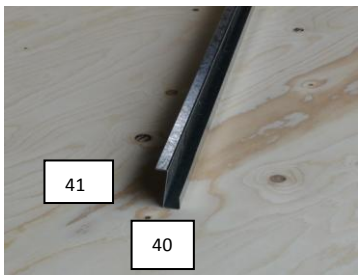
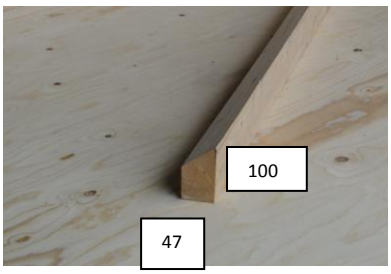
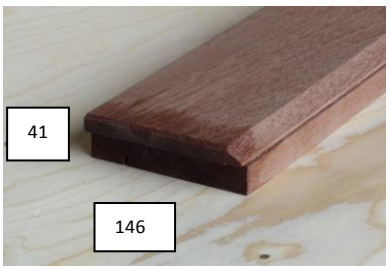
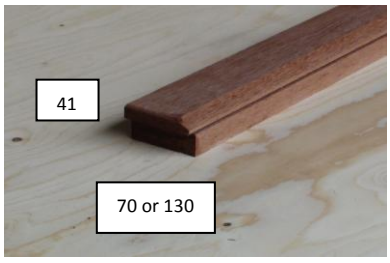
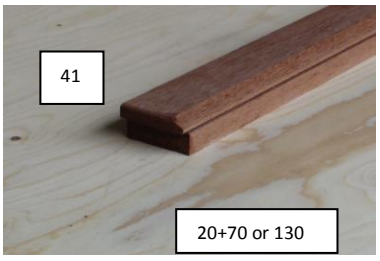
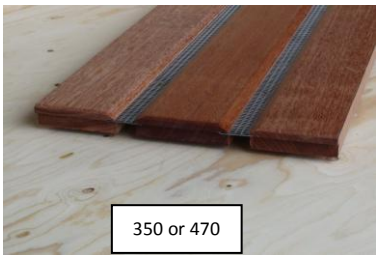
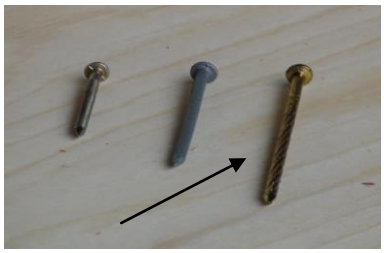
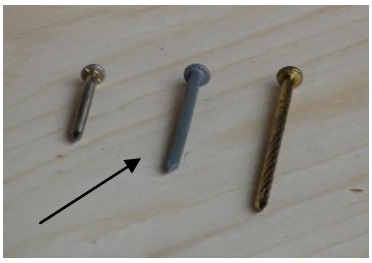
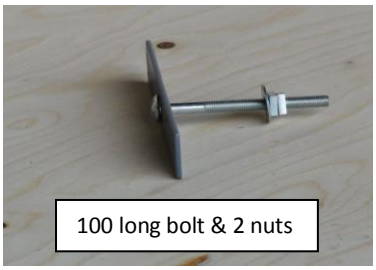
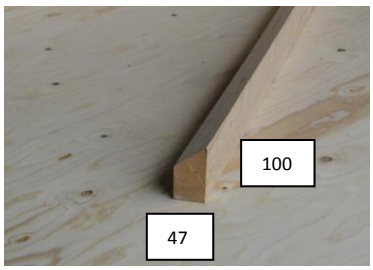
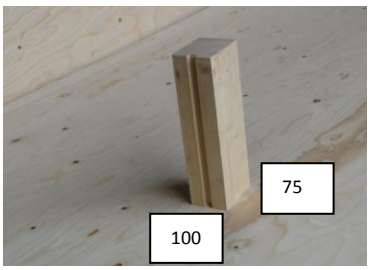
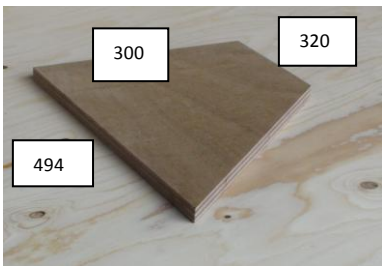
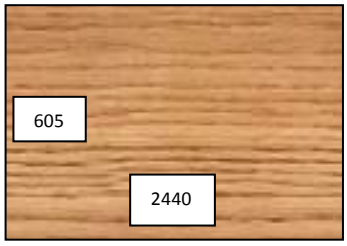
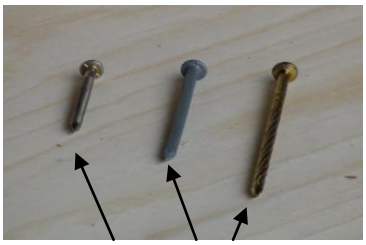
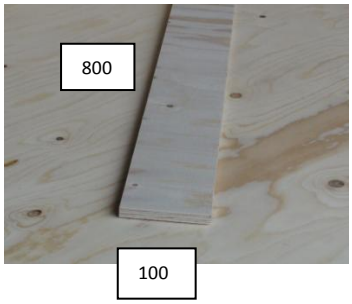
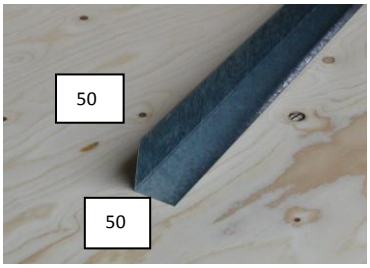
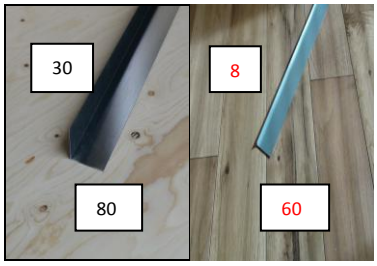
HIGH PERFORMANCE VENTILATION SYSTEMS

Timber Floor Parts Identification Sheet (mm)

1. Main Bearer  	2. Intermediate Bearer  	3. Floor End Stop Ply 
4. Door Seat Flashing Steel  	5. Tunnel Arris Board T1  	6. Top Board 
7. Starter Boards  Drill ends for nails	8. Door Seat Boards  Drill ends for nails	9. Cleaning Out Doors 
10. Top Board Nails 	11. Mesh Nails 	12. Ply Strips 41mm x 12mm  'C' length will vary according to width of floor

13. Hardwood 32mm x 41mm 	14. Cleaning out Door Handle  	15. Meshes 56mm wide  Perforated Blank
16. T1 Duct Rail & Upstand  	17. T2 Vertical Support  	18. T4 Divider Ply 18mm 
19. T5 Cover Ply 12mm Sheets  Cut to width on-site	20. Joining Strip  To join ply cover plate together Requires mastic for air seal	21. Nails  45 65 80
22. Ply Plates (Connector Plates)  	23. Corner Flashing  Drill & nail to suit on-site	24.  Angle Flashing Steel Seat

Floor Installation Diagrams

Diagram 1

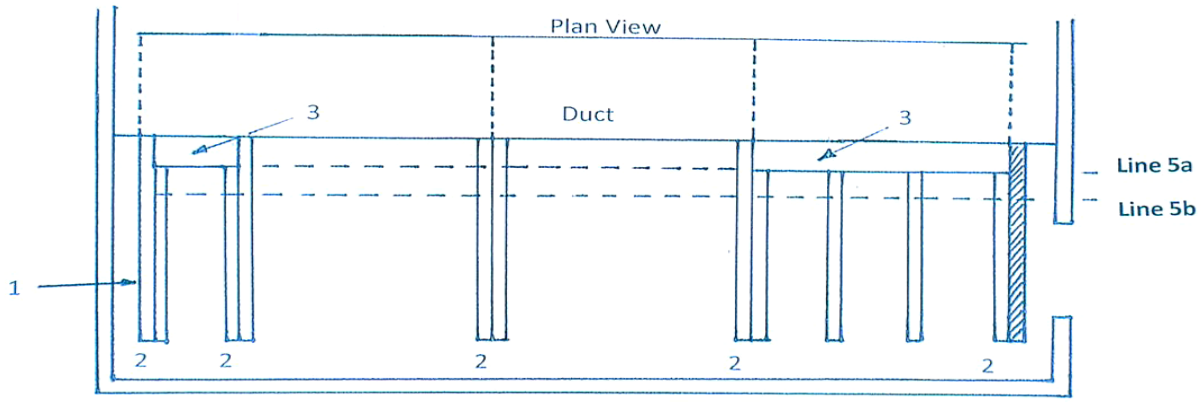


Diagram 2

Cross Section

Duct

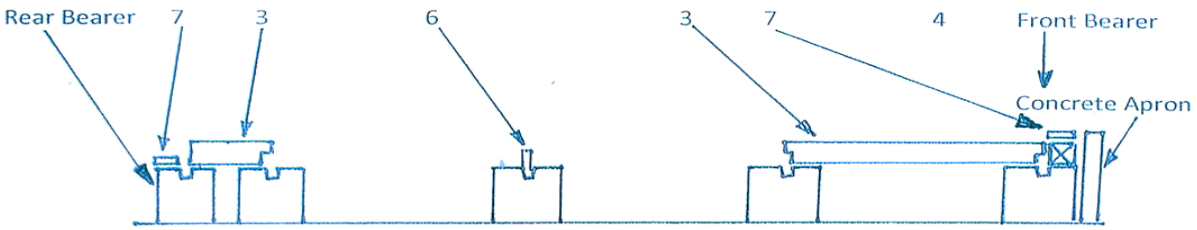


Diagram 3

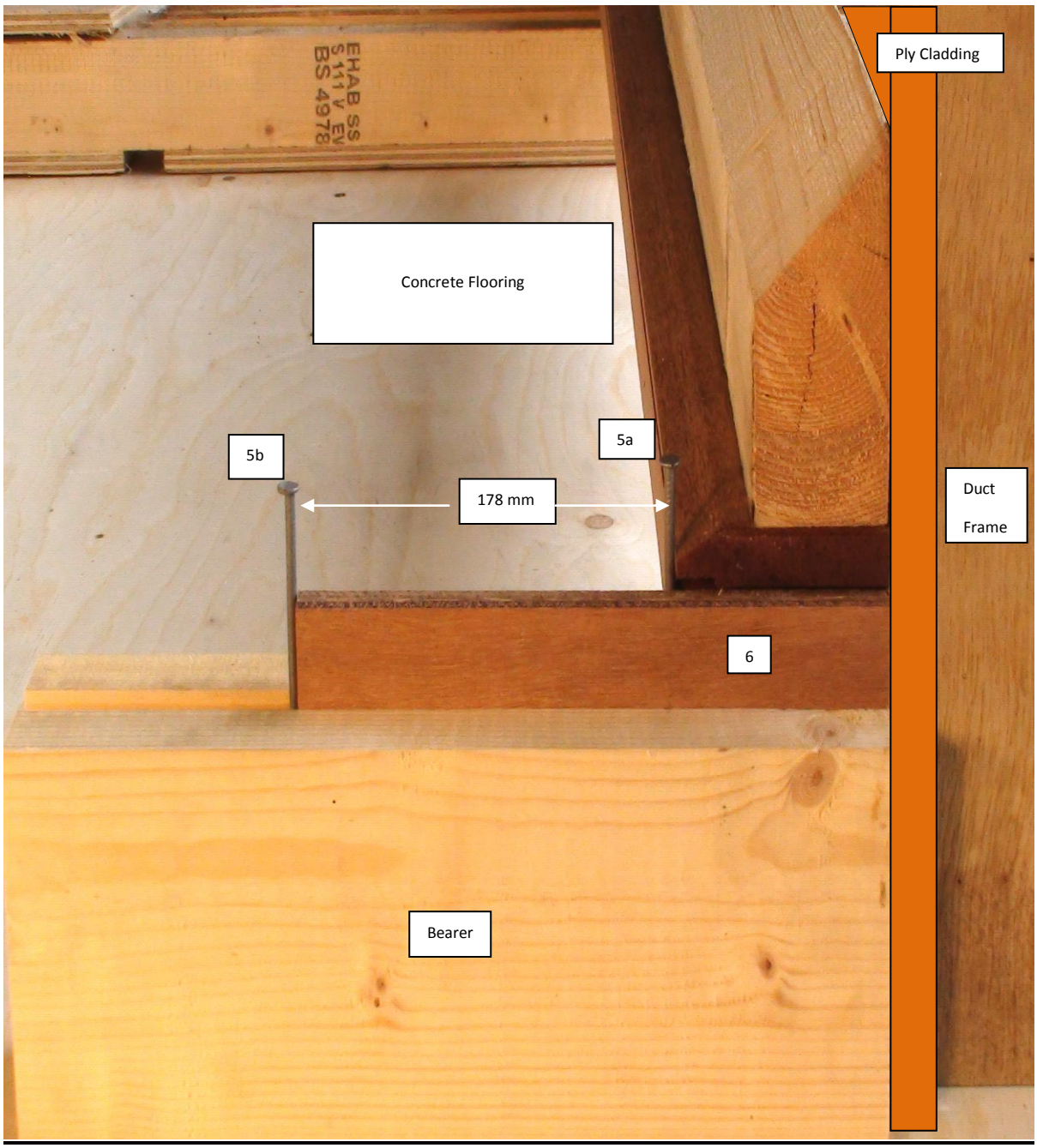

Ply Cladding
Concrete Flooring
5a
5b
178 mm
Duct
Frame
6
Bearer

Diagram 4

Plan View

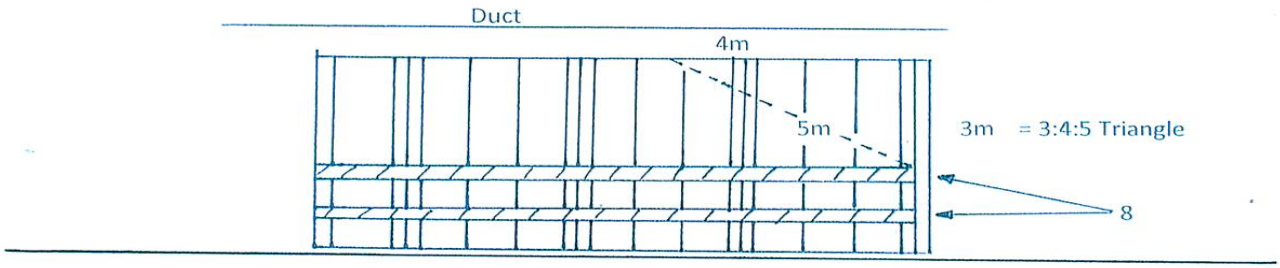


Diagram 5

Cross Section

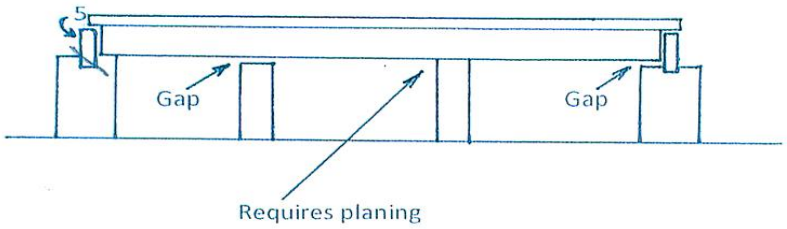


Diagram 6

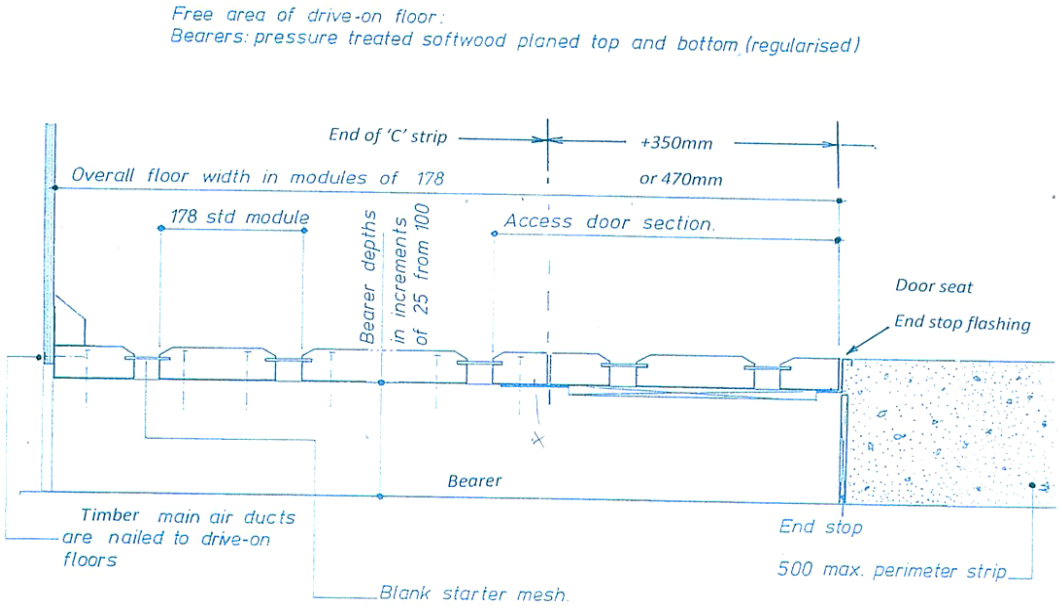
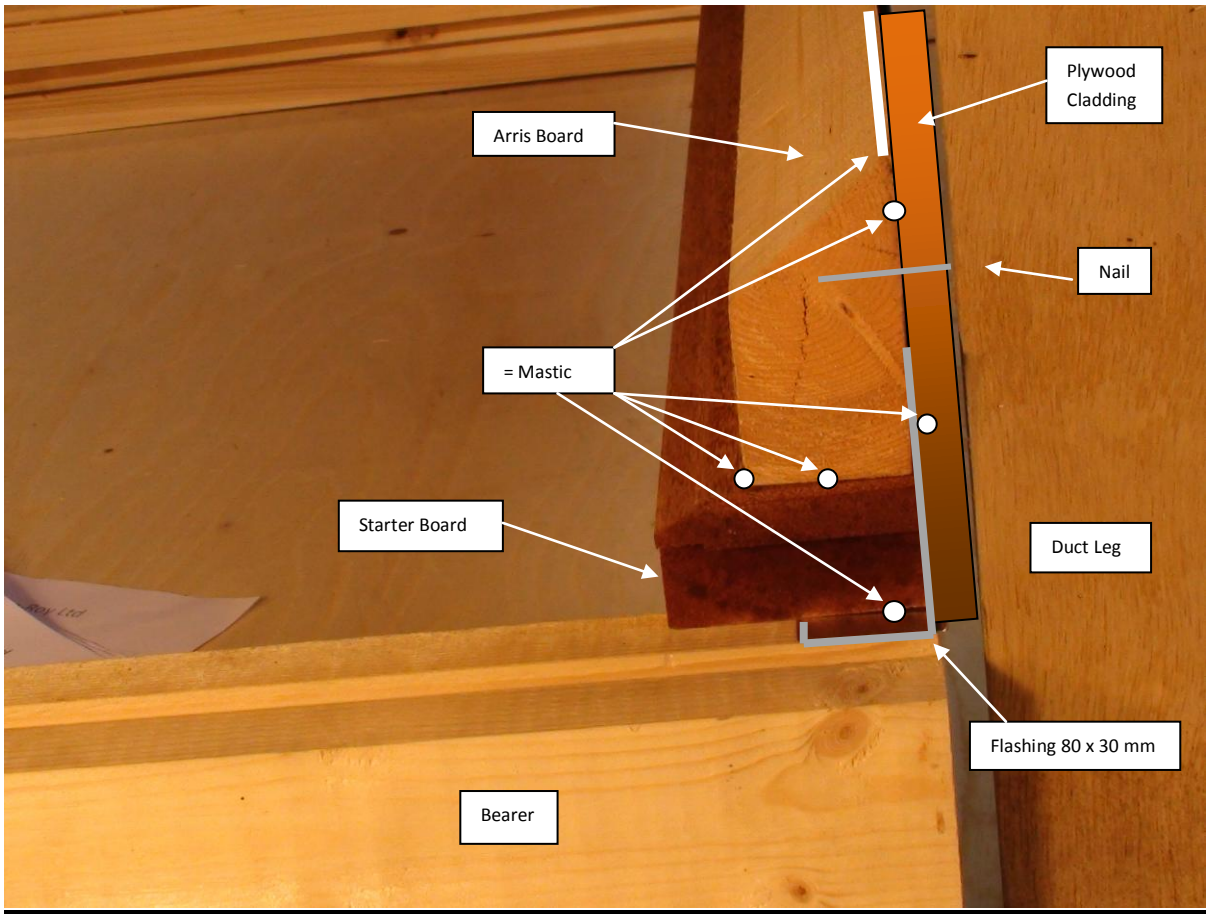

Free area of drive-on floor:
Bearers: pressure treated softwood planed top and bottom (regularised)
End of 'C' strip
+350mm
or 470mm
Overall floor width in modules of 178
178 std module
Bearer depths in increments of 25 from 100
Access door section.
Door seat
End stop flashing
Bearer
Timber main air ducts are nailed to drive-on floors
End stop
500 max. perimeter strip
Blank starter mesh.

Diagram 7


Plywood Cladding
Arris Board
Nail
= Mastic
Starter Board
Duct Leg
Flashing 80 x 30 mm
Bearer

Laying the Floor

1. **Preparation** You will have received customized plans and parts lists for your self-installation project with the delivery of the materials. Read the plans and parts list carefully before you start. Check all materials are present and that no damage has occurred in transit. Clear the work area of all debris and any materials not required for the drive-on floor installation task. All parts are identified in the guide by an item number – this number is shown in brackets after each item specified in the text.

2. **Installation**

3. Determine the first outlet from the main air duct at the rear end of the store. This should allow a perimeter strip of between 300 and 500 mm from the back of the building to the edge of the floor. **See Item 1 on diagram 1.**

4. Lay out one 75 mm wide main bearer (1) at each board spacing (1220 mm) tight up to the duct **See Item 2 on Diagram 1.** Notch around any obstructions or protrusions along the air duct such as bolt or screw heads to ensure a good air seal between the end of the bearer and the air duct. If any bearer rocks or bows upwards, cut 75% of the way through the bearer to allow it to follow the profile of the concrete floor.

5. Place one starter board (7) on top of a flashing (24) on top of the bearers at each end of the floor tight up to the duct with the single mesh groove facing outwards. **See Diagram 7.** Do not nail these boards at this stage. **See Item 3 on diagrams 1 & 2.** Starter boards are either 70 mm or 130 mm wide with a groove for the mesh on one side only and will be supplied one size only depending on the overall size of the supplied floor.

6. Nail a piece of 32 mm x 41 mm edging timber (13) to the outside edge of the front main bearer**. See Item 4 on diagram 2.**

7. Pull a string line through the front of the two starter boards placed in (6) above. Lightly tap nails into the bearers as spacers to leave a gap between the front of the boards and the string to help maintain a straight line. **See Line 5a in diagram 1 and Item 5a on diagram 3.** Nail these two starter boards in position and then nail the rest of the starter boards in place keeping the front edges of the boards in line with the string line and the ends tight to each other over the centre line of the main bearers. **See Item 6 on diagram 2. Note:** If the duct is not straight either plane off the back of the starter board or fit a fillet of wood as required to fill the

gap and keep the starter boards straight with no gaps between the duct ply and the boards.

8. Place one 'A' plywood strip (12) on top of the 32 mm x 41 mm front edge timber (13) at the front of the floor and one flat on the bearer at the back of the floor. Nail the strips temporarily in position in line with a pencil mark at the front of the starter boards and 178 mm from the front edge of the starting board pointing away from the duct. **See Item 6 on diagrams 2 and 3.**

9. Use a string line off the store-side edge of the plywood strips to line in all the other 'A' strips which are placed in the grooves in the main bearers under the starter boards. **See Item 5b on diagram 3.** Fix the ply strips in position carefully using a nail into the bearer. **See Item 5 on diagram 5.**

10. Place intermediate bearers in position under the starter boards at the correct spacing and nail in position. Hardwood boards have 406 mm spacing, softwood 305 mm spacing.

11. Place more main bearers at both ends of the floor to the full width of the building. Fix 32 mm x 41 mm edging timber (13) to the front bearer to within 300 mm of the side of the building.

12. Check the width of the cleaning out doors (9). These will be either 350 mm or 470 mm depending on overall floor size. Measure several boards (to allow for natural shrinkage) and record the largest dimension of the doors measured.

13. Use sufficient 'B' strips (12) pushed up tight to each other and to the 'A' strips, and then a 'C' strip (12) with the short spacing away from the duct to be between door width 350 mm or 470 mm + 300 mm to 500 mm perimeter strip away from the side of the building. The strips on the front bearer should be temporarily fixed on top of the edging strip, and the strips on the rear bearer fixed to the top of the bearer behind the groove. **See Item 7 on diagram 2.**

14. Add the largest dimension of cleaning-out door recorded in (13) above to the end of the 'C' strips. This should leave a perimeter strip of between 300 mm and 500 mm from the side of the building. Cut the first and last bearers to this dimension. **See diagram 6.**

15. Ensure all bearers are pushed up tight to the duct then pull a chalk line between these two bearer ends. All the other main and intermediate bearers can now be cut to length to the chalk line. If any bearer rocks or bows upwards, cut 75% of the way through to allow the bearer to follow the line of the concrete.

16. Fit the 'B' and 'C' strips into the main bearer grooves, pushing them up tight to each other, fixing them with a hand hammered nail into the bearer. Ensure that the board alignment marks on the strips are facing towards the end of the floor where you will start laying the top boards – normally the front.
17. Square up the front bearer in relation to the row of starter boards. Use a 3:4:5-triangle. **See diagram 4.** Wedge or fix the front main bearer in this position.
18. Starting at the front of the floor check that none of the intermediate bearers are proud of the main bearers by using a straight edge. Plane any intermediate bearers that are proud. **See diagram 5.**
19. Place a top board in position half way across the width of the floor and another beside the clean out door position to space out the main bearers. **See note 8 on diagram 4.**
20. Fit guides to a top board to space out the intermediate bearers as you lay the floor boards.
21. Lay the floor starting from the front lining up the boards with the marks on the ply strips. Note that the meshes have a right way up and a right way round and that the first mesh on each run beside the duct will be a solid one. Use two nails at each board/bearer connection.
22. The last board in each run is a door seat, identified by a groove in the lower face of the board. This is a board with a metal strip protruding from one side and will line up with the ends of the 'C' strips. **See diagram 6.** Fit the door seat to the underside of the board before nailing in place.
23. Once the entire floor has been laid, remove the ply strips nailed to the rear bearer and replace with 32 mm x 41 mm edging strip. Check that the bearers protrude from the end of the 'C' strips by the door width. If any are too long then cut back. Use a spacer the same length as the door width to fit the door seat steel to the very ends of the bearers by drilling and nailing in place with a 65mm nail at every main bearer. **See diagram 6.**
24. Nail the end-stop shuttering ply (3) to the ends of the bearer. **See diagram 6.** The cleaning out doors can now be laid in position. All except the first door will have a ply sealing strip at one end.
25. The second door from the front has lifting handles fitted. Remove the two screws at the end nearest the start of the floor that are holding the meshes in position.

Drill these holes out to 8.5 mm. Rest the door handles over these holes, drop the 100 mm long bolts through the holes and tighten two nuts together at the end of the bolts.

26. Drill a 4.5 mm hole 10 to 15 mm in from each end of every mesh (excluding the lift-out doors) and fix with 65 mm mesh nails to the bearer underneath. Check for gaps between boards and meshes and fill with mastic or silicone as required.
27. Install rubbing board (5) by nailing from the outside with 90mm nails into every duct frame leg. Use mastic on every joint and nail using a nail gun from inside the duct into the rubbing board at 100mm spacings. Finally, run a bead of mastic along the top and bottom edges of the rubbing board (5).
28. Complete a final check of the floor ensuring that all nail heads are flush or sunk just below the level of top boards and that all mesh nails are fully embedded. Clean the finished floor of all residual debris and allow sealants to dry for 24 hours before loading crops or cereals.

Laying the Floor with a Standard Transition Duct (Vertical Face Main Duct)

1. **Preparation** You will have received customized plans and parts lists for your self-installation project with the delivery of the materials. Read the plans and parts list carefully before you start. Check all materials are present and that no damage has occurred in transit. Clear the work area of all debris and any materials not required for the drive-on floor installation task. All parts are identified in the guide by an item number – this number is shown in brackets after each item specified in the text.
2. **Installation**
3. Determine the first outlet from the main air duct at the rear end of the store. This should allow a perimeter strip of between 300 and 500 mm from the back of the building to the edge of the floor. **See Item 1 on diagram 1.**
4. Lay out one 75 mm wide main bearer (1) at each board spacing (1220 mm) tight up to the duct **See Item 2 on Diagram 1.** Notch around any obstructions or protrusions along the air duct such as bolt or screw heads to ensure a good air seal between the end of the bearer and the air duct. If any bearer rocks or bows upwards, cut 75% of the way through the bearer to allow it to follow the profile of the concrete floor.
5. Place one starter board (7) on top of a flashing (24) on top of the bearers at each end of the floor 337mm away from duct to the back of the board with the single mesh groove facing outwards. **See Diagram 7.** Do not nail these boards at this stage. **See Item 3 on diagrams 1 & 2.** Starter boards are either 70 mm or 130 mm wide with a groove for the mesh on one side only and will be supplied one size only depending on the overall size of the floor.
6. Nail a piece of 32 mm x 41 mm edging timber (13) to the outside edge of the front main bearer starting tight to the main duct**. See Item 4 on diagram 2.**
7. Pull a string line through the front of the two starter boards placed in (6) above. Lightly tap nails into the bearers as spacers to leave a gap between the front of the boards and the string to help maintain a straight line. **See Line 5a in diagram 1 and Item 5a on diagram 3.** Nail these two starter boards in position and then nail the rest of the starter boards in place keeping the front edges of the boards in line with the string line and the ends tight to each other over the centre line of the main bearers. **See Item 6 on diagram 2. Note:** If the duct is not straight either

plane off the back of the starter board or fit a fillet of wood as required to fill the gap and keep the starter boards straight with no gaps between the duct ply and the boards.

8. Place one 'A' plywood strip (12) on top of the 32 mm x 41 mm front edge timber (13) at the front of the floor and one flat on the bearer at the back of the floor. Nail the strips temporarily in position in line with a pencil mark at the front of the starter boards and 178 mm from the front edge of the starting board pointing away from the duct. **See Item 6 on diagrams 2 and 3.**
9. Use a string line off the store-side edge of the plywood strips to line in all the other 'A' strips which are placed in the grooves in the main bearers under the starter boards. **See Item 5b on diagram 3.** Fix the ply strips in position carefully using a nail into the bearer. **See Item 5 on diagram 5.**
10. Place intermediate bearers in position under the starter boards at the correct spacing and nail in position. Hardwood boards have 406 mm spacing, softwood 305 mm spacing. **Note: Ensure that the bearers do not protrude beyond the starter boards towards the main duct.**
11. Place more main bearers at both ends of the floor to the full width of the building. Fix 32 mm x 41 mm edging timber (13) to the front bearer to within 300 mm of the side of the building.
12. Check the width of the cleaning out doors (9). These will be either 350 mm or 470 mm depending on overall floor size. Measure several boards (to allow for natural shrinkage) and record the largest dimension of the doors measured.
13. Use sufficient 'B' strips (12) pushed up tight to each other and to the 'A' strips, and then a 'C' strip (12) with the short spacing away from the duct to be between door width 350 mm or 470 mm + 300 mm to 500 mm perimeter strip away from the side of the building. The strips on the front bearer should be temporarily fixed on top of the edging strip, and the strips on the rear bearer fixed to the top of the bearer behind the groove. **See Item 7 on diagram 2.**
14. Add the largest dimension of cleaning-out door recorded in (13) above to the end of the 'C' strips. This should leave a perimeter strip of between 300 mm and 500 mm from the side of the building. Cut the first and last bearers to this dimension. **See diagram 6.**
15. Ensure all bearers are pushed up tight to the duct then pull a chalk line between these two bearer ends. All the other main and intermediate bearers can now be

cut to length to the chalk line. If any bearer rocks or bows upwards, cut 75% of the way through to allow the bearer to follow the line of the concrete.

16. Fit the 'B' and 'C' strips into the main bearer grooves, pushing them up tight to each other, fixing them with a hand hammered nail into the bearer. Ensure that the board alignment marks on the strips are facing towards the end of the floor where you will start laying the top boards – normally the front.
17. Square up the front bearer in relation to the row of starter boards. Use a 3:4:5-triangle. **See diagram 4.** Wedge or fix the front main bearer in this position.
18. Starting at the front of the floor check that none of the intermediate bearers are proud of the main bearers by using a straight edge. Plane any intermediate bearers that are proud. **See diagram 5**.
19. Place a top board in position half way across the width of the floor and another beside the clean out door position to space out the main bearers. **See note 8 on diagram 4.**
20. Fit guides to a top board to space out the intermediate bearers as you lay the floor boards.
29. Lay the floor starting from the front lining up the boards with the marks on the ply strips. Note that the meshes have a right way up and a right way round and that the first mesh on each run beside the duct will be a standard mesh. Use two nails at each board/bearer connection. Fit the door seat to the underside of the board before nailing in place.
21. The last board in each run is a door seat, identified by a groove in the lower face of the board. This is a board with a metal strip protruding from one side and will line up with the ends of the 'C' strips. **See diagram 6.**
22. Once the entire floor has been laid, remove the ply strips nailed to the rear bearer and replace with 32 mm x 41 mm edging strip. Check that the bearers protrude from the end of the 'C' strips by the door width. If any are too long then cut back. Use a spacer the same length as the door width to fit the door seat steel to the very ends of the bearers by drilling and nailing in place with a 65mm nail at every main bearer. **See diagram 6.**
23. Nail the end-stop shuttering ply (3) to the ends of the bearer. See diagram 6. The cleaning out doors can now be laid in position. All except the first door will have a ply sealing strip at one end.

24. The second door from the front has lifting handles fitted. Remove the two screws at the end nearest the start of the floor that are holding the meshes in position. Drill these holes out to 8.5 mm. Rest the door handles over these holes, drop the 100 mm long bolts through the holes and tighten two nuts together at the end of the bolts.

25. Drill a 4.5 mm hole 10 to 15 mm in from each end of every mesh (excluding the lift-out doors) and fix with 65 mm mesh nails to the bearer underneath. Check for gaps between boards and meshes and fill with mastic or silicone as required.

26. Install rubbing board (5) by nailing from the outside with 90mm nails into every duct frame leg. Use mastic on every joint and nail from inside the duct into the rubbing board at 100mm spacings. Finally, run a bead of mastic along the top and bottom edges of the rubbing board (5).

27. Complete a final check of the floor ensuring that all nail heads are flush or sunk just below the level of top boards and that all mesh nails are fully embedded. Clean the finished floor of all residual debris and allow sealants to dry for 24 hours before loading crops or cereals.

28. **Transition Duct Assembly** Place a T2 vertical support (noggin) (17) on top of each main bearer with a bead of mastic behind tight to the duct. Note that the noggins may be bevelled at one end to accommodate the angle of an existing (old style) sloping duct wall – the bevelled end should be at the bottom sitting on the main bearer. Fix to the bearer with 90 mm nails at an angle. **Note: If required, additional support can be placed at the end of the building and the transition duct extended beyond the end of the floor. In this case the T1 rails and T5 ply will extend beyond the floor and must be supported where they meet the building cladding.**

29. Place the T1 Duct Rail (16) on top of the T2 noggins with a bead of mastic behind and fixed to the duct with screws (if timber duct) or coach bolts (if metal duct) or screws and plastic plugs (if concrete duct) at nominal 610 mm spacing. **Note: The T1 Duct Rail may differ slightly in shape from the T1 Upstand to enable it to fit the existing duct's profile.**

30. Place the T1 Upstand (16) on top of the floor starter board as if it was a rubbing board. Place a bead of mastic between the T1 and the floor board. Use 90 mm nails through the T1 into the floor boards at nominal 610 mm spacing.

31. Fix the 800 mm x 100 mm ply plates (22) centrally to the back of the bottom T1 and the starter board and fix with 45 mm nails at 100 mm spacing.
32. Fix the T4 18 mm thick ply divider plates (18) to the side of the floor bearer and the T2 vertical support (17) with 45 mm nails at 100 mm spacing as shown in **Figure 1.** Note that the plates may need trimming to fit due to any floor or duct undulations effects on the structure. Fill any gaps with mastic and/or spray-foam. Now mark the centre line of these ply divider plates on the front face of the bottom T1 rail and on the side of the duct just above the top T1 rail to identify the nail line for the T5 cover plates.
33. Cut one long edge of the T5 cover ply (19) at a 45 degree angle.
34. Measure the distance between the top of the top T1 timber and the floor side face of the bottom T1 timber. Use this measurement to cut each T5 cover plate to the correct width with a 45 degree cut **(Figure 1).**
35. Mastic the tops of the two T1 timbers and the T4 ply plates before fixing the T5 cover plates. Nail through the T5 cover plates using 45 mm nails at 100 mm spacing into the two T1 timbers and the into top edge of the T4 plates where you have identified the centre line in (32).
36. Use joining strip with mastic to join the ply cover plates together.
37. Trim the bottom of the T5 cover plate if it extends beyond the front face of the T1 rail.
38. Cut to shape and fix from 12 mm cover ply end plates if required to transition duct and fix 50 mm x 50 mm flashing to tidy the edges of the transition duct where required.
39. Run a bead of mastic along the top and bottom edges of the T5 cover ply and where the bottom T1 meets the floor starter board.
40. Complete a final check of the floor ensuring that all nail heads are flush or sunk just below the level of top boards and that all mesh nails are fully embedded. Clean the finished floor of all residual debris and allow sealants to dry for 24 hours before loading crops or cereals.