

PHILIPPINE NATIONAL STANDARD

PNS/BAFS 322:2021

Agricultural Tramline System – Specifications



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Foreword

In 2016, the Philippine Council for Agriculture and Fisheries (PCAF) –Agricultural and Fishery Mechanization Committee (AFMeC) issued Resolution No. 6, series of 2016 (Endorsing to the DA Secretary through the BAFS the Identified Agricultural Fisheries Machinery, Equipment and Infrastructures for Philippine Agricultural Engineering Standards [PAES]/ PNS Development and Updating) endorsing the development of a PNS for ATS. A Technical Working Group (TWG) was created to develop the PNS under Special Order No. 817, series of 2021 (Addendum to Special Order No. 81 series of 2021 entitled, “Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machinery, and Equipment”), which is composed of representatives from relevant government agencies, academe, research institution, and private sector. The draft PNS underwent a series of TWG meetings and stakeholder consultations conducted via online platforms before their endorsement to the Secretary for approval.

This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2.

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1 Scope

This standard specifies the minimum specifications and construction requirements for an engine Agricultural Tramline System (ATS) to be used for transport of agriculture and fisheries products and inputs mainly crops, poultry, and fish and fishery products.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

American Society for Testing and Materials (ASTM). (2016). Standard specification for loadbearing concrete masonry units (ASTM C90).

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3 Terms and Definitions

For the purpose of this Standard, the following terms and definitions shall apply:

3.1

Agricultural Tramline System (ATS)

hauling facility used for the conveyance of agriculture and fishery products and inputs in farm areas not accessible by any service road, and where transport is extremely difficult due to different obstacles of the terrain such as rivers, ravines, and steep mountain slopes

3.2

cable sag

ratio of the difference in deflection of the cable without the carrier and the deflection of the cable when the carrier is positioned at the midpoint without any load to the horizontal distance from Tower A to Tower B expressed in percentage, %

3.3

carriage

device that supports the carrier along the traction cable of the ATS

3.4

carrier

part of the ATS where agriculture and fisheries products and inputs for transport are loaded

3.5

carrier capacity

maximum weight carried from Tower A to B

3.6

continuous brake power

power recommended by the manufacturer for satisfactory operation under continuous duty condition within a specified speed range

3.7

engine

device that acts as a mechanical source of power for the ATS to function

3.8

engine house

structure where the engine is situated and where the operator controls the hauling operation

3.9

geotechnical investigation

performed to evaluate the soil, rock, ground water, geologic, and seismologic conditions that potentially affect the design and construction of a proposed development which will include structures

3.10

maximum cable linear speed

maximum allowable speed of the carrier moving through the traction cable

3.11

roller pulley

connects the carrier to the track cable

3.12

sheds

acts as storage area for agriculture and fisheries products and inputs being transported

3.13

track cable

cable that carries the load and serves as path for the carrier

3.14

traction cable

cable that facilitates the movement of the carrier from tower A to tower B

3.15

tower

serves as support to pulleys and cables

3.15.1

tower A

tower near the service road (see Figure 2)

3.15.2

tower B

tower near the production area (see Figure 2)

3.16

traction pulley

pulley that supports the movement of the traction cable

4 Classification

The classification of ATS should be based but not limited to the following:

4.1 Monocable

A monocable ATS has one major cable that functions as both traction and tracking cable for the tramline system.

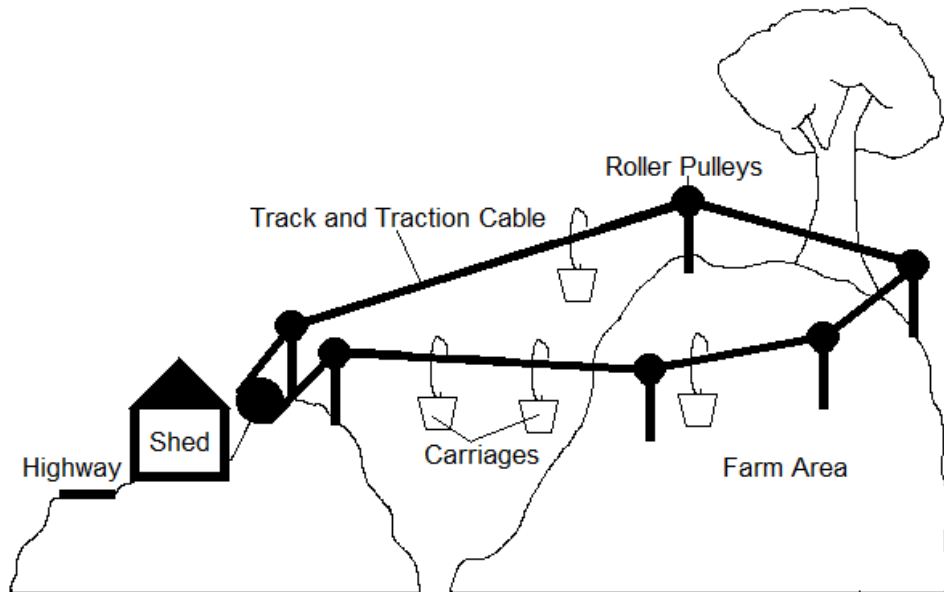


Figure 1. Typical drawing setup of a monocable ATS

4.2 Bicable

A bicable ATS has two cables, namely, track cable which is fixed and used for supporting the load, and traction cable which is used to pull the load. The traction cable should be completely independent from the track cable and should be directly connected to the prime mover.

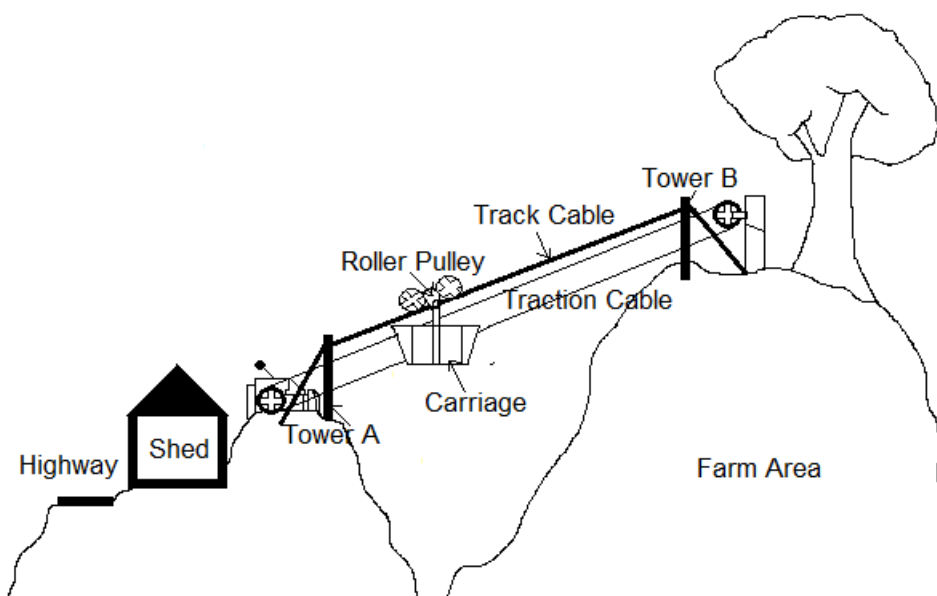


Figure 2. Typical drawing setup of a bicable ATS

5 Geotechnical Investigation

Before construction, a geotechnical investigation shall be conducted in the area where the ATS will be built. The results of the geotechnical investigation shall then

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be incorporated into the design of the ATS. Other requirements related to the installation site of the ATS shall conform to RA 6541 (NBCP).

6 Construction and Structural Requirements

6.1 Engine

The engine requirement of the ATS shall be at least 80% of the rated continuous brake power of the engine based on manufacturer's specifications. Maximum fuel consumption and type of engine shall conform to manufacturer's specifications.

6.2 Cables

The cable materials shall be conforming to ASTM A931 (Standard test method for tension testing of wire ropes and strand) and ASTM A1023 (Standard specification for carbon steel wire ropes for general purposes). The minimum specifications for track and traction cables are listed in Annex A (ATS track and traction cable minimum specifications).

6.2.1 Track Cable

The required minimum diameter for track cables shall be 25 mm.

6.2.2 Traction Cable

The required minimum diameter for traction cable shall be 12 mm.

6.3 Posts

The structural steel to be used for the components of the ATS shall conform to AWS D1.1 (Structural welding — Steel), ASTM A36 (Standard specification for carbon structural steel), ASTM A615 (Standard specification for deformed and plain carbon-steel bars for concrete reinforcement), and ASTM A53 (Standard specification for pipe, steel, black and hot-dipped, zinc-coated, welded and seamless). Concrete components shall conform to ASTM C90 (Standard specification for loadbearing concrete masonry units) and ASTM C129 (Standard specification for nonloadbearing concrete masonry units).

6.4 Pulleys

Plummer blocks or pillow blocks with sleeves and nipple grease should be used. The traction pulleys shall be secured properly to prevent vibration. The minimum specifications for pulleys are listed in Annex B (Pulleys [minimum specifications]).

6.5 Carrier and Carriage

6.5.1 The carriage shall be constructed using galvanized iron pipe for the track cable.

6.5.2 The carrier shall be constructed using steel conforming to AWS D1.1 (Structural welding — Steel) and carbon steel conforming to ASTM A36 (Standard specification for carbon structural steel). The gates shall be constructed from the same material to prevent products from falling during transport.

6.5.3 ASTM F3125 (Standard specification for high strength structural bolts and assemblies, steel and alloy steel, heat treated, inch dimensions 120 ksi and 150 ksi minimum tensile strength, and metric dimensions 830 MPa and 1040 MPa minimum tensile strength) shall be followed for any bolted connections.

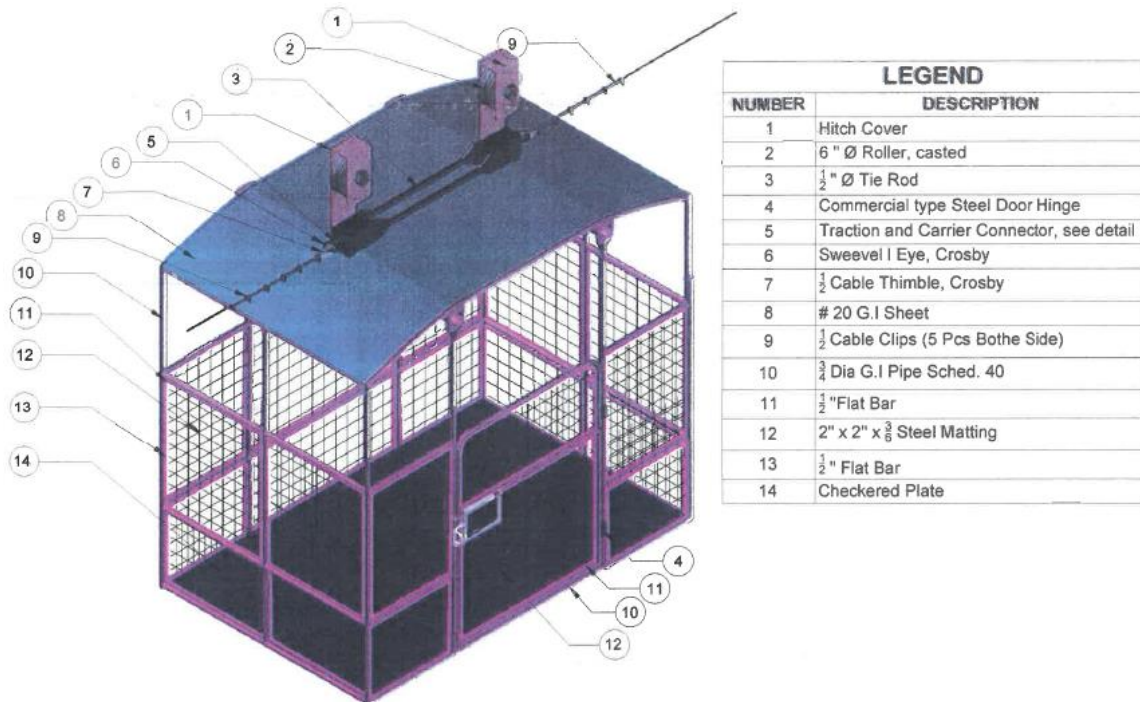


Figure 3. Sample carrier and carriage details and dimensions

6.5.4 The carrier capacity shall be dependent on the diameter of cable to be used. A table of cable diameter to carrier capacity, including its weight, relationship is provided in Annex C (Cable diameter – carrier capacity relationship).

6.6 Engine House and Sheds

The engine houses and sheds are categorized as agricultural structures, falling under Group J (Accessory) of RA 6541 (NBCP).

6.6.1 The engine house or shed should be constructed with the appropriate urinals and wash area. It shall be located in an accessible and secured area, with proper lighting. There shall be a perimeter fence surrounding the engine house.

6.6.2 The trusses of the shed shall either be made with steel or wood, depending on the availability of materials. For steel trusses, steel conforming to AWS D1.1 (Structural welding — Steel), reinforcing steel bars conforming to ASTM A615 (Standard specification for deformed and plain carbon-steel bars for concrete reinforcement) and carbon steel conforming to ASTM A36 (Standard specification for carbon structural steel) shall be used.

6.6.3 The roofing materials shall conform to ASTM A653 (Standard specification for steel sheet, zinc-coated [galvanized] or zinc-iron alloy-coated [galvannealed] by the hot-dip process).

6.6.4 ASTM F3125 (Standard specification for high strength structural bolts and assemblies, steel and alloy steel, heat treated, inch dimensions 120 ksi and 150 ksi minimum tensile strength, and metric dimensions 830 MPa and 1040 MPa minimum tensile strength) shall be followed for bolted connections.

6.6.5 For wooden materials, timber conforming to ASTM D245 (Standard practice for establishing structural grades and related allowable properties for visually graded lumber) shall be used.

6.6.6 The concrete masonry units shall conform to ASTM C90 (Standard specification for loadbearing concrete masonry units) and ASTM C129 (Standard specification for nonloadbearing concrete masonry units).

6.6.7 The perimeter fence should be made using Galvanized Iron (GI) pipes and mesh wire.

7 Performance Requirements

7.1 The performance of the ATS shall be in accordance with the criteria as specified in Table 1.

Table 1. Performance criteria for ATS

Criteria	Performance Data
Maximum cable linear speed, m/min	150
Cable sag, %	5-15

7.2 The fuel consumption during operation shall be less than or equal to the fuel consumption specified by the engine manufacturer.

8 Safety Requirements

8.1 An enclosure shall be provided in the loading and unloading area conforming to PAES 101:2000 (Technical means for ensuring safety - General).

8.2 The platform in the loading and unloading area shall be wide enough to allow ease of movement and to avoid accidents befalling the operators and haulers.

8.3 Means of monitoring the prevailing winds and seismic activity in the location should be provided to determine safety during transporting. Operation shall be halted in case of strong cross winds.

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8.4 A brake device, such as a mechanically activated brake, shall be provided along with a manually operated backup system in case of engine failure, error in operation or other emergency situations.

8.5 The trail of the ATS shall not cross over any residential area, power lines, and hanging water lines to avoid any hazards or accidents due to falling loads or sagging cable.

8.6 There shall be earmuffs or other ear protection device provided for the operators to use when 92 dB(A) is exceeded during operation.

8.7 The orientation of the exhaust for the engine shall be directed away from the engine house and with the capability to be redirected by the operators.

8.8 All rotating components shall be properly covered with safety guards.

8.9 Overloading of the ATS shall be strictly prohibited.

8.10 The carrier and carriage shall be coated with paint to avoid rusting.

9 Equipment and Accessories

9.1 Personal Protective Equipment (PPE), including ear muffs for noise protection, shall be provided for each operator on site.

9.2 Fittings such as sockets, shackles, and turn buckles shall be provided to secure cable attachments and connections to other cables, posts and holding points. The type of materials for fittings and accessories are specified in Annex D (ATS accessories material type [minimum specifications]).

9.3 Radio communication shall be provided between operators on-site. In case of unavailable radio communication, a signalling system shall be implemented as an alternative.

9.4 Weighing scale shall be provided on site for determining maximum allowable load during operation.

10 Warranty for Construction and Services

10.1 Warranty shall be provided for parts and services except for normal wear and tear of expendable or consumable maintenance parts for at least one year upon the acceptance of procuring entity of the ATS as per PNS/BAFS/PAES 192:2016 (Guidelines on after-sales service).

10.2 Additional warranties shall conform to RA 9184 (Government Procurement Reform Act of 2003).

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11 Maintenance

11.1 Each engine unit shall be provided with the following basic hand tools: one set of open wrenches, one piece each of Philips and flat screw-driver, and other hand tools applicable to the unit.

11.2 The pulleys shall be lubricated every three months with proper lubricant able to penetrate the core of the cables, protecting it internally and externally and maximize their lifespan.

11.3 A grease gun shall be provided for lubrication purposes especially for the pillow block pulleys used.

11.4 Checking of the discard criteria, explained in Annex E (Discard criteria), and tensioning of cables shall be practiced regularly for maintenance of cables.

12 Operation

12.1 An instruction manual, which conforms to PAES 102:2000 (Operator's manual content and presentation), shall be provided.

12.2 The manufacturers/distributors/dealers shall provide training on the operation, repairs, and maintenance of the ATS.

13 Testing

13.1 The ATS shall be tested in accordance with PNS/BAFS 323:2021 (Agricultural tramline system – Methods of test).

13.2 The cables shall be tested prior to installation according to wire rope testing procedures falling under ISO 3108:2017 (Steel wire ropes — Test method — Determination of measured breaking force).

Annex A

(Informative)

ATS track and traction cable minimum specifications

A.1 Track Cable

A.1.1 Right hand lang's lay (RLL or zZ Lay) "Pre-stretched" Fiber Core/Steel Core;

A.1.2 Non-galvanized or Bright finished;

A.1.3 Bitumin based Lubrication;

A.1.4 Preformed; and

A.1.5 Improved Plow Steel Grade 1770 N/mm².

A.2 Traction Cable

A.2.1 Right hand regular lay (ROL or sZ Lay) "Pre-stretched" Steel and Fiber Core;

A.2.2 Non-galvanized or Bright finished;

A.2.3 Bitumin based Lubrication;

A.2.4 Preformed; and

A.2.5 Improved Plow Steel Grade 1770 N/mm².

Annex B
(Informative)

Pulleys (minimum specifications)

B.1 Traction cable

B.1.1 High speed, heavy duty;

B.1.2 1045 tool steel, casted steel-quenched and tempered; and

B.1.3 Double-roller bearing, sealed type with ASTM F3125 axle bolted.

B.2 Carriage assembly

B.2.1 1045 tool steel; and

B.2.2 Roller bearing, sealed type (2205 2RS) with ASTM F3125 bolt pin.

B.3 Towers

B.3.1 With bolted 31.75 mm ASTM F3125 bolt

Annex C
(Informative)

Cable diameter – carrier capacity relationship

Table C.1. Cable diameter versus the breaking force depending on the core

Size		Fibre Core			Steel Core		
Nominal Diameter		Approximate Weight	Minimum Breaking Force (1770 N/mm ²)	Minimum Breaking Force (1960 N/mm ²)	Approximate Weight	Minimum Breaking Force (1770 N/mm ²)	Minimum Breaking Force (1960 N/mm ²)
mm	in	kg/m	kg	kg	kg/m	kg	kg
6	1/4	0.125	2,000	2,375	0.137	2,160	2,560
7		0.177	2,920	3,230	0.195	3,150	3,490
8	5/16	0.231	3,810	4,220	0.255	4,110	4,560
9	3/8	0.292	4,820	5,340	0.322	5,200	5,760
10		0.361	5,950	6,590	0.398	6,420	7,120
11	7/16	0.437	7,210	7,980	0.482	7,770	8,610
12		0.437	8,570	9,490	0.573	9,250	10,300
13	1/2	0.610	10,100	11,110	0.673	10,800	12,000
14	9/16	0.708	11,600	12,950	0.780	12,600	14,000
16	5/8	0.924	15,300	16,720	1.020	16,400	18,300
18		1.170	19,300	21,410	1.290	20,800	23,000
19	3/4	1.300	21,500	23,750	1.440	23,100	25,700
20		1.440	23,900	26,410	1.590	25,700	28,400
22	7/8	1.750	28,800	31,910	1.930	31,100	34,500
24		2.080	34,300	38,030	2.290	37,000	41,000
25		2.260	37,226	41,700	2.490	40,159	46,900
26	1-0/0	2.440	40,300	44,560	2.690	43,400	48,100
28	1-1/8	2.830	46,700	51,690	3.120	50,400	55,800
29		3.050	50,091	52,510	3.360	54,038	58,900
30		3.270	53,605	59,358	3.600	57,829	64,035
32	1-1/4	3.700	61,000	67,500	4.080	65,700	72,900
35	1-3/8	4.420	73,000	80,760	4.880	78,700	87,200
36		4.680	77,200	85,450	5.160	83,300	92,200
38	1-1/2	5.210	85,900	95,240	5.750	92,800	103,000
40		5.780	95,300	106,050	6.370	103,000	114,000
41	1-5/8	6.380	100,123	107,070	7.040	108,012	119,300
44	1-3/4	6.990	115,000	127,460	7.710	124,000	138,000
45		7.650	120,613	133,580	8.400	130,116	143,700
48	1-7/8	8.320	137,000	151,930	9.170	148,000	164,000
52	2-0/0	9.760	161,000	178,000	10.170	173,000	192,000
54	2-1/8	10.530	162,000	178,000	11.610	174,000	200,000
57	2-1/4	12.350	181,000	199,000	13.750	194,000	224,000
60	2-3/8	14.480	214,000	237,000	14.700	231,000	255,000
64	2-1/2	16.210	243,000	270,000	16.600	263,000	291,000
68		18.510	275,000	304,000	18.800	297,000	329,000
70	2-3/4	1.590	291,000	323,000	19.900	314,000	348,000

NOTE: Commonly used cable diameter are 12 mm (1/2 in) and 25 mm (1 in)

Annex D
(Informative)

ATS accessories material type (minimum specifications)

D.1 Shackles

D.1.1 Forged Quench and Tempered;

D.1.2 Hot dipped Galvanized; and

D.1.3 Meets or exceeds requirements of EN13889:2003 or ASME B30.26 with Certificates.

D.2 W/R Clips

D.2.1 Drop-Forged;

D.2.2 Entire Clip Galvanized; and

D.2.3 Meets or exceeds requirements of EN13411:2003 or ASME B30.26 with Certificates.

D.3 Sockets

D.3.1 Galvanized Forged Steel Sockets with Certificates

D.4 Turnbuckles

D.4.1 Hot-dipped Galvanized steel, quenched and tempered with Certificates

D.5 Thimbles

D.5.1 Heavy Duty Galvanized

Annex E
(Informative)

Discard criteria

E.1 These criteria conform to ISO 4309:2017 (Cranes — Wire ropes — Care and maintenance, inspection and discard).

E.2 Table E.1 shows the reference table to determine whether ropes should be discarded and replaced.

Table E.1. Discard criteria reference table

Rope Category Number (RCN)	Number of load-bearing wires (n) in all outer strands of the rope	Number of visible broken wires	
		Roper over a length of 6 x diameter	Rope over a length of 30 x diameter
01	$n \leq 50$	2	4
02	$51 \leq n \leq 75$	3	6
03	$76 \leq n \leq 100$	4	8
04	$101 \leq n \leq 120$	5	10
05	$121 \leq n \leq 140$	6	11
06	$141 \leq n \leq 160$	6	13

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