

# MEDICAL STANDARDS FOR OFFICER CANDIDATES

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## CHAPTER 1

### GENERAL INSTRUCTIONS

1.1.1. In this section the medical standards of candidates for commissioning into flying, ground duty branches in the IAF are given. For Airmen and NCs (E) also most of these standards will apply.

1.1.2. The basic requirements of medical fitness are essentially the same for all branches, except for aircrew whose visual acuity, anthropometry and certain other physical standards are higher. A candidate will not be assessed physically fit unless the examination as a whole shows that he/ she is physically and mentally capable of withstanding severe physical and mental strain for prolonged periods in any climate in any part of the world.

1.1.3. The results of initial examination are recorded on AFMSF – 2. The medical examination consists of: -

(a) *A questionnaire, which is to be carefully and truthfully completed by the candidate and countersigned by the examining medical officer. The importance of all aspects of the questionnaire, including the legal aspect, should be emphasized on all candidates. Any subsequent detection of disability, not declared earlier, will lead to disqualification at any stage prior to commissioning.*

(b) A complete medical and surgical examination including dental examination and gynecological examination in women.

(c) An ophthalmic examination, and

(d) An examination of the ears, nose and throat.

1.1.4. Each M.O/ Specialist conducting part of the examination completes the appropriate section of the form and affixes his/her signature at the end of each section. The President of the Medical Board then assesses the overall fitness of the candidate. To ensure that the results recorded on different candidates are comparable, it is important that standard testing apparatus and procedures are used.

1.1.5. The medical standards spelt out in this section pertain to initial entry medical standards. Continuation of medical fitness will be assessed during the periodic medical examinations held at NDA/ AFA/ AFTC prior to commissioning. If, however, any disease or disability is detected during the training phase, which will have a bearing on the flight cadets subsequent physical fitness and medical category; such cases will be referred expeditiously to IAM (for

aircrew)/Specialists of MH under intimation to the office of DGMS (Air): Med -7. At IAM, if the disease or disability is of a permanent nature an early decision for the cadet to continue in the service / branch / stream is to be taken.

## CHAPTER 2

### GENERAL MEDICAL AND SURGICAL ASSESSMENT

1.2.1. Every candidate, to be fit for the Air Force, must conform to the minimum standards laid down in the succeeding paragraphs. The general build should be well developed and proportionate.

#### **Surgical Sequelae and Abnormalities**

1.2.2. **Sequelae of Fractures/ Old injuries**. The residual effects of such fractures/ injuries are to be assessed for any functional limitation. If there is no effect on function, the candidate can be assessed fit. Cases of old fractures of spine are unfit. Any residual deformity of spine or compression of a vertebra will be cause for rejection. Injuries involving the trunks of the larger nerves, resulting in loss of function, or scarring, which cause pain or cramps, indicate unsuitability for employment in flying duties. The presence of large or multiple keloids will be cause for rejection.

1.2.3. **Scars and Birth Marks**. Minor scars for e.g. as resulting from the removal of tuberculous glands do not, per se, indicate unsuitability for employment on flying duties. Extensive scarring of a limb or torso that may cause functional limitation or unsightly appearance should be considered unfit.

1.2.4. **Cervical Rib**. A well fully developed unilateral cervical rib or a rudimentary large cervical rib with signs or symptoms referable to the rib is a cause for rejection. Rudimentary small cervical rib without signs or symptoms referable to it may be considered fit. However, the defect is to be recorded as a minor disability in the medical board proceedings. Bilateral cervical ribs without any neurovascular compromise will be acceptable.

1.2.5. Asymmetry of the face and head, which will interfere with proper fitting of oxygen mask and helmet, will be a cause for rejection for flying duties.

1.2.6. **History relating to operations**. A candidate who has undergone an abdominal operation, other than a simple appendectomy, involving extensive surgical intervention or partial or total excision of any organ is, as a rule, unsuitable for flying duties. Operation involving the cranial vault (e.g.trephining), or extensive thoracic operations such as thoracoplasty make the candidate unfit for flying.

#### **Measurement and Physique**

1.2.7. **Chest shape and circumference**. The shape of the chest is as important as its actual measurement. The chest should be well proportioned and well developed with the minimum range of expansion of 5 cm. Decimal fraction lower than 0.5 cm will be ignored. 0.5 cm will be recorded as such and 0.6 cm and above will be recorded as 1 cm.

1.2.8. **Height, Sitting Height, Leg Length and Thigh Length**. The minimum height for entry into ground duty branches will be 157.5 cm.

1.2.9. Minimum height for Flying Branch Acceptable measurements of leg length, thigh length and sitting height for such aircrew will be as under: -

- (a) Sitting height - Minimum 81.50 cm  
- Maximum 96 .0 cm
- (b) Leg Length - Minimum 99.0 cm  
- Maximum 120.0 cm
- (c) Thigh Length - Maximum 64.0 cm

1.2.10. On account of lower age group of NDA candidates a margin of up to 5.0 cm in height, 2.5 cm in leg length (minimum) and 1.0 cm in sitting height (minimum) may be given provided it is certified by the medical board that the candidate is likely to grow and come up to the required standard on completion of his training at NDA. The actual growth is to be confirmed at the time of V term medical at NDA.

#### 1.2.11. **Weight**

(a) **Male Candidates (except NDA candidates)**. Ideal weight relative to age and height is as depicted in Appendix A to this chapter. For male candidates (except NDA candidates), the maximum permissible variation from the ideal body weight is  $\pm 1SD$ . Fraction of less than half a Kg will not be noted.

(b) **NDA Candidates**. For NDA candidates, at entry, the weight chart prescribed by U.P.S.C. placed at Appendix B to this chapter will be applicable. placed at Appendix B to this chapter will be applicable. Fraction of less than half a Kg will not be noted. If a candidate is overweight by more than 10 % of the ideal weight, biochemical parameters will be assessed to rule out any underlying pathology. Candidates with weight between 10 to 20 % of ideal with normal biochemical profile, normal waist circumference (< 94 cm:Males and 89 cm: Females), normal BMI range (M< 25, F< 23) and normal waist to hip ratio (< 0.9: Males and <0.8: Females) may be assessed fit. It must be ensured that all the four obesity parameters mentioned before are normal. Abnormality in any one of them will be a cause for rejection. Genetic factors must also be considered in young age obesity. Skin fold thickness and measurement of body fat with body fat analyzers, where available, may be done. Such candidates, if found fit, would be advised to reduce weight to less than 10% of ideal which should be ensured by the time the candidate joins NDA and subsequently, AFA (this stipulation is also endorsed in the joining instructions of the candidate). Candidates with weight more than 20 % above the ideal, with or without biochemical abnormalities, or BMI more than 25 or waist circumference more than 94cm, or WHR > 0.9 will be declared unfit. If a candidate is underweight by more than 10% below the ideal, a detailed history and careful examination to rule out possible causes like tuberculosis, hyperthyroidism, diabetes etc will be carried out. If no cause is detected the candidate will be declared fit. If any cause is detected the fitness of the candidate will be decided accordingly.

#### 1.2.12. **Physical Standards (For Females)**.

(a) **Height**. The minimum height acceptable for various branches are as follows:-

- (i) Flying Branch - 162.5 cm.

(ii) Medical / Dental branches – 142 cm

(iii) Other Branches – 152 cm

**Note:** For other than flying branches only – For candidates belonging to the North East region or hilly regions of Uttarakhand, a lower minimum height of 142 cm will be accepted.

(b) **Weight.** Weight should conform to the standards given for height and age as given in Appendix C to this chapter. Variations upto  $\pm 1$ SD for female candidates are acceptable.

Appendix A

(Refers to para 1.2.11)

**MALE IDEAL WEIGHTS IN KG FOR DIFFERENT AGE GROUPS**

**AND HEIGHTS OF NORMAL INDIVIDUALS**

in mm	AGE RANGE							
	15-17	18-22	23-27	28-32	33-37	38-42	43-47	>48
1520	46	47	50	54	54	54	55	54
1530	47	47	51	55	55	54	56	54
1540	47	48	51	56	55	55	57	55
1550	48	49	52	56	56	56	57	56
1560	48	49	53	57	57	56	58	56
1570	49	50	54	58	58	57	58	57
1580	49	50	54	58	58	58	59	58
1590	50	51	55	59	59	59	60	58
1600	51	52	56	59	60	59	60	59
1610	51	52	56	60	60	60	61	60
1620	52	53	57	61	61	61	62	60
1630	52	54	58	61	62	61	62	61
1640	53	54	59	62	63	62	63	62
1650	53	55	59	63	63	63	64	62
1660	54	56	60	63	64	64	64	63
1670	54	56	61	64	65	64	65	64
1680	55	57	61	65	65	65	65	65
1690	55	57	62	65	66	66	66	65
1700	56	58	63	66	67	67	67	66
1710	56	59	64	66	68	67	67	67

1720	57	59	64	67	68	66	68	67
1730	58	60	65	68	69	69	69	68
1740	58	61	66	68	70	69	69	69
1750	59	61	66	69	71	70	70	69
1760	59	62	67	70	71	71	71	70
1770	60	62	68	70	72	72	71	71
1780	60	63	69	71	73	72	72	71
1790	61	64	69	72	73	73	73	72
1800	61	64	70	72	74	74	73	73
1810	62	65	71	73	75	75	74	73
1820	62	66	72	74	76	75	74	74
1830	63	66	72	74	76	76	75	75
1840	64	67	73	75	77	77	76	75
1850	64	68	74	75	78	77	76	76
1860	65	68	74	76	78	78	77	77
1870	65	69	75	77	79	79	78	77
1880	66	69	76	77	80	80	78	78
1890	66	70	77	78	81	80	79	79
1900	67	71	77	79	81	81	80	79
1910	67	71	78	79	82	82	80	80
1920	68	72	79	80	83	82	81	81
1930	68	73	79	81	83	83	81	82
SD ±	6.0	6.3	7.1	6.6	6.9	6.8	5.8	7.26

### Appendix B

(Refers to para 1.2.11)

### MALE IDEAL NUDE WEIGHTS IN KILOGRAMS FOR DIFFERENT AGE GROUPS AND HEIGHTS FOR NDA CANDIDATES ON ENTRY

**(10% VARIATION ON HIGHER SIDE OF AVERAGE ACCEPTABLE)**

Height in cm	AGE IN YEARS/WEIGHT IN KG		
	15 – 16	16 – 17	17 – 18
(a)	(b)	(c)	(d)
152	41.0	42.5	44.0

155	42.0	43.5	45.3
157	43.0	45.0	47.0
160	45.0	46.5	48.0
162	46.5	48.0	50.0
165	48.0	50.0	52.0
167	49.0	51.0	53.0
170	51.0	52.5	55.0
173	52.5	54.5	57.0
175	54.5	56.0	59.0
178	56.0	58.0	61.0
180	58.5	60.0	63.0
183	61.0	62.5	65.0



**Appendix C**

(Refers to para 1.2.12)

**TABLE 5: IDEAL HEIGHT-WEIGHT CHART FOR DIFFERENT AGE GROUPS FOR FEMALE INDIVIDUALS**

**CHAPTER 3**

**CARDIOVASCULAR SYSTEM**

**1.3.1. Relevant history.** History of chest pain, breathlessness, palpitation, fainting attacks, giddiness, rheumatic fever, chorea, frequent sore throats and tonsillitis should be given due consideration in assessment of the cardiovascular system.

**1.3.2. Pulse.** The normal pulse rate varies from 60-100 bpm. Persistent sinus tachycardia (> 100 bpm), after emotional factors and fever are excluded as causes, as well as, persistent sinus bradycardia (< 60 bpm), should be referred for specialist opinion to exclude organic causes. Sinus arrhythmia and vagotonia should be also be excluded.

**1.3.3.** Candidates are quite prone to develop White Coat Hypertension, which is a transient rise of Blood Pressure, due to

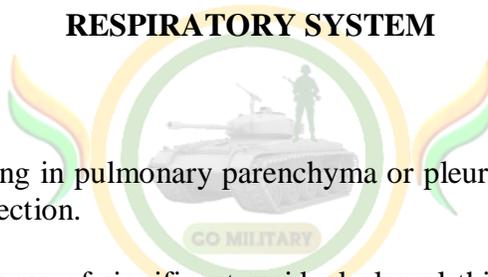
the stress of medical examination. Every effort must be made to eliminate the White Coat effect by repeated recordings under basal conditions. When indicated, ambulatory BP recording must be carried out or the candidate admitted to hospital for observation before final fitness is certified. An individual with BP consistently greater than 140/90 mm Hg shall be rejected.

**1.3.4.** Evidence of organic cardio vascular disease will be cause for rejection. Diastolic murmurs are invariably organic. Short systolic murmurs of ejection systolic nature and not associated with thrill and which diminish on standing, specially if associated with a normal ECG and Chest X-Ray, are most often functional. However an echocardiogram should always be done to exclude organic heart disease. In case of any doubt the case should be referred to cardiologist for opinion.

**1.3.5. Electro Cardiograms.** Assessment of a properly recorded ECG (resting – 14 lead) should be carried out by a medical specialist. Note will be taken of wave patterns, the amplitude, duration and time relationship. At initial entry no abnormalities are acceptable except incomplete RBBB in the absence of structural heart disease, which must be excluded. In such cases, opinion of Senior Adviser or Cardiologist will be obtained.

## CHAPTER 4

### RESPIRATORY SYSTEM



**1.4.1. Pulmonary TB.** Any residual scarring in pulmonary parenchyma or pleura, as evidenced by a demonstrable opacity on chest skiagram will be a ground for rejection.

**1.4.2. Pleurisy with Effusion.** Any evidence of significant residual pleural thickening will be a cause for rejection. Old treated cases with no residual abnormality can be accepted if the diagnosis and treatment was completed more than two year earlier. In these cases, a CT scan chest and fibro optic bronchoscopy with bronchial lavage can be done alongwith USG, ESR, and Mantoux test. If all the tests are normal the candidate may be considered fit.

**1.4.3. Bronchitis.** History of repeated attacks of cough/ wheezing/ bronchitis may be manifestations of chronic bronchitis or other chronic pathology of the respiratory tract. Such cases will be assessed unfit.

**1.4.4. Bronchial Asthma.** History of repeated attacks of bronchial asthma/wheezing/ allergic rhinitis will be a cause for rejection.

**1.4.5. Radiographs of the chest.** Definite radiological evidence of disease of the lungs, mediastinum and pleurae indicates unsuitability for employment in air force.

## CHAPTER 5

### GASTRO INTESTINAL SYSTEM

1.5.1. Relevant History. The examiner should enquire whether the candidate has any past history of ulceration or infection of the mouth, tongue, gums or throat. Record should be made of any major dental alteration.

1.5.2. When discussing a candidate's medical history the examiner must ask direct questions about any history of heart burn, history of recurrent dyspepsia, peptic ulcer-type pain, persistent diarrhoea, jaundice or biliary colic.

1.5.3. Dental Standards. The following dental standard will be followed:-

(a) Candidate must have 14 dental points and the following teeth must be present in the upper jaw in good functional opposition with the corresponding teeth in the lower jaw, and these must be sound or repairable:-

(i) Any four of the six anteriors, and

(ii) Any six of the ten posteriors

(iii) They should be balancing on both sides. Unilateral mastication is not allowed.

(iv) Any removable or wired prosthesis are not permitted.

(b) Candidate whose dental standard does not conform to the laid down standard will be rejected.

(c) Candidate with dental arches affected by advanced stage of generalized active lesions of pyorrhoea, acute ulcerative gingivitis, and gross abnormality of the teeth or jaws or with numerous caries or septic teeth will be rejected.

1.5.4 Gastro-Duodenal disabilities. Candidates who are suffering or have suffered, during the previous two years, from symptoms suggestive of chronic indigestion, including proven peptic ulceration, are not to be accepted, in view of the exceedingly high risk of recurrence of symptoms and potential for incapacitation. Any past surgical procedure involving partial or total loss of an organ (other than vestigial organs/ gall bladder) will entail rejection.

1.5.5 Diseases of the Liver. If past history of jaundice is noted or any abnormality of the liver function is suspected, full investigation is required for assessment. Candidates suffering from viral hepatitis or any other form of jaundice will be rejected. Such candidates can be declared fit after a minimum period of 6 months has elapsed provided there is full clinical recovery; HBV and HCV status are both negative and liver functions are within normal limits.

1.5.6 Disease of spleen. Candidates, who have undergone splenectomy, are unfit, irrespective of the cause for operation. Splenomegaly of any degree is a cause for rejection.

1.5.7. Hernia. A candidate with a well-healed hernia scar, after successful surgery, will be considered fit six months after surgery, provided there is no potential for any recurrence and abdominal musculature is good.

1.5.8. Abdominal Surgery.

(a) A candidate with well-healed scar after conventional abdominal surgery will be considered fit after 6 months of

successful surgery provided there is no potential for any recurrence of the underlying pathology and abdominal wall musculature is good.

(b) A candidate after laparoscopic cholecystectomy will be considered fit three months after successful surgery.

1.5.9. USG Abdomen: Disposal of cases with incidental ultrasonographic findings like fatty liver, small cysts, haemangiomas, septate gall bladder etc., will be based on clinical significance and functional capacity.

## CHAPTER 6

### UROGENITAL SYSTEM

1.6.1. Relevant History. Enquiry should be made about any alteration in micturition, e.g. dysuria or frequency. Recurrent attacks of cystitis; pyelonephritis and haematuria must be excluded. Detailed enquiry must be made about any history of renal colic, attacks of acute nephritis, any operation on the renal tract including loss of a kidney, passing of stones or urethral discharges. If there is any history of enuresis, past or present, full details must be obtained.

1.6.2. Urine Examination.

(a) **Proteinuria**. Proteinuria will be a cause for rejection, unless it proves to be orthostatic.

(b) **Glycosuria**. When glycosuria is detected, a blood sugar examination (Fasting and after 75 g glucose) and Glycosylated Hb is to be carried out, and fitness decided as per results. Renal glycosuria is not a cause for rejection.

(c) **Urinary Infections**. When the candidate has history or evidence of urinary infection it will entail full renal investigation. Persistent evidence of urinary infection will entail rejection.

(d) **Haematuria**. Candidates with history of haematuria will be subjected to full renal investigation.

1.6.3. Glomerulonephritis.

(a) **Acute**. In this condition there is a high rate of recovery in the acute phase, particularly in childhood. A candidate who has made a complete recovery and has no proteinuria may be assessed fit, after a minimum period of one year after full recovery.

(b) **Chronic**. Candidate with chronic glomerulonephritis will be rejected.

1.6.4. Renal Colic and Renal Calculi. Complete renal evaluation is required. Candidates with renal calculi will be rejected.

1.6.5. Absence of Kidney. All candidates found to have congenital absence of one kidney or who have undergone unilateral nephrectomy will be rejected. Presence of horseshoe kidney will entail rejection. Solitary functioning kidney with diseased, non-functional contralateral kidney will entail rejection. Crossed ectopia, unascended kidney(s) will be a cause for rejection.

1.6.6. Undescended Testis. Bilateral undescended testis / atrophied testis will be a cause for rejection. Unilateral undescended testis, if entirely retained in the abdomen, is acceptable. If it lies in the inguinal canal, at the external ring or

in the abdominal wall, such cases may be accepted after either orchiectomy or orchipexy operation. In all doubtful cases surgical opinion must be obtained regarding fitness.

1.6.7. Hydrocele or Varicocele. These should be properly treated before fitness is considered. Minor degree of varicocele should not entail rejection.

## CHAPTER 7

### ENDOCRINE SYSTEM

**1.7.1.** Generally any history suggestive of endocrine disorders will be a cause for rejection.

**1.7.2.** All cases of thyroid swelling having abnormal iodine uptake and abnormal thyroid hormone levels will be rejected. Cases of simple goiter with minimal thyroid swelling, who are clinically euthyroid and have normal iodine uptake and normal thyroid functions may be accepted.

**1.7.3.** *Candidates detected to have diabetes mellitus will be rejected. A candidate with a family history of diabetes mellitus will be subjected to blood sugar and Glycosylated Hb evaluation, which will be recorded.*

## CHAPTER 8

### DERMATOLOGICAL SYSTEM

1.8.1. Relevant history and examination. Careful interrogation followed by examination of the candidates skin is necessary to obtain a clear picture of the nature and severity of any dermatological condition claimed or found. Borderline skin conditions should be referred to a dermatologist. Candidates who give history of sexual exposure, or have evidence of healed penile sore in the form of a scar should be declared permanently unfit, even in absence of an overt STD, as these candidates are likely 'repeaters' with similar indulgent promiscuous behavior.

1.8.2. Assessment of diseases of the Skin. Acute non-exanthematous and noncommunicable diseases, which ordinarily run a temporary course, need not be a cause of rejection. Diseases of a trivial nature, and those, which do not interfere with general health or cause incapacity, do not entail rejection.

**1.8.3.** Certain skin conditions are apt to become active and incapacitating under tropical conditions. An individual is unsuitable for service if he has a definite history or signs of chronic or recurrent skin diseases. Some such conditions are described below:-

(a) Palmoplantar Hyperhydrosis. Some amount of Palmoplantar Hyperhydrosis is physiological, considering the situation that recruits face during medical examination. However, conditions with significant Palmoplantar Hyperhydrosis should be considered unfit.

(b) Acne Vulgaris. Mild (Grade 1) Acne consisting of few comedones or papules, localized only to the face may be acceptable. However moderate to severe degree of acne (nodulocystic type with or without keloidal scarring) or involving the back should be considered unfit.

(c) Palmoplantar Keratoderma. Any degree of palmoplantar keratoderma manifesting with hyperkeratotic and

fissured skin over the palms, soles and heels should be considered unfit.

(d) **Ichthyosis Vulgaris**. Ichthyosis involving the upper and lower limbs, with evident dry, scaly, fissured skin should be considered unfit. Mild Xerosis (dry skin) could be considered fit.

(e) **Keloids**. Candidates having any keloid should be considered unfit.

(f) **Onychomycosis**. Clinically evident onychomycosis of finger and toenails should be declared unfit, especially if associated with nail dystrophy. Mild degree of distal discolouration involving single nail without any dystrophy may be acceptable.

(g) **Giant Congenital Melanocytic Naevus**. Giant congenital melanocytic naevi, greater than 10 cm should be considered unfit, as there is a malignant potential in such large sized naevi.

(h) **Callosities, corns and warts**. Small sized callosities, corns and warts may be considered acceptable after treatment. However candidates with multiple common warts or diffuse palmoplantar mosaic warts, large callosities on pressure areas of palms and soles and multiple corns should be rejected.

(j) **Psoriasis**. Psoriasis is a chronic skin condition known to relapse and/or recur and hence should be considered unfit.

(k) **Leukoderma**. Candidates suffering from minor degree of Leukoderma affecting the covered parts may be accepted. Vitiligo limited only to glans and prepuce maybe considered fit. But those having extensive degree of skin involvement and especially, when the exposed parts are affected, even to a minor degree, should not be accepted.

**1.8.4.** A history of chronic or recurrent attacks of skin infections will be cause for rejection. A simple attack of boils or sycosis from which there has been complete recovery may be considered for acceptance.

**1.8.5.** Individuals who have chronic or frequently recurring attacks of a skin disease of a serious or incapacitating nature e.g. eczema are to be assessed as permanently unfit and rejected.

**1.8.6.** Any sign of Leprosy will be a cause for rejection.

1.8.7. **Naevi**. Naevus depigmentosus, Beckers Naevus may be considered fit. Intradermal Naevus, Vascular Naevi may be considered unfit.

1.8.8. **Ptyriasis Versicolor**. Mild P Versicolor may be considered fit. Extensive Ptyriasis Versicolor may be considered unfit.

1.8.9. **Tinea Cruris and Tinea Corporis**. Maybe considered fit on recovery.

1.8.10. **Scrotal Eczema**. Maybe considered fit on recovery.

1.8.11 **Canities** (premature graying stain) maybe considered fit if mild in nature and no systemic association is seen.

1.8.12. Intertrigo. Maybe considered fit on recovery.

1.8.13. Sexually Transmitted Diseases : Genital Ulcers. These should be considered unfit.

1.8.14. Scabies. Maybe considered fit only on recovery. Genital scabies maybe made unfit.

## CHAPTER 9

### MUSCULOSKELETAL SYSTEM AND PHYSICAL CAPACITY

#### Physical Endurance

**1.9.1.** The assessment of the candidate's physique is to be based upon careful observation of such general parameters as apparent muscular development, age, height, weight and the correlation of this i.e. potential ability to acquire physical stamina with training. The candidate's physical capacity is affected by general physical development or by any constitutional or pathological condition.

#### Spinal Conditions

1.9.2. Relevant history. Past medical history of disease or injury of the spine or sacroiliac joints, either with or without objective signs, which has prevented the candidate from successfully following a physically active life, is a cause for rejection for commissioning. History of spinal fracture/ prolapsed intervertebral disc and surgical treatment for these conditions will entail rejection.

1.9.3. Examination. Mild kyphosis or lordosis where deformity is barely noticeable and not associated with pain or restriction of movement may be accepted. When scoliosis is noticeable or any pathological condition of the spine is suspected, X-ray examination of the appropriate part of the spine needs to be carried out.

**1.9.4. X-Ray Spine. For flying duties, X-ray (AP and lateral views) of cervical, thoracic and lumbosacral spines is to be carried out.** For ground duties, X-ray examination of spine may be carried out, if deemed necessary.

**1.9.5. Assessment.** The following conditions detected radiologically will disqualify a candidate for Air Force service: -

- (a) Granulomatous disease of spine.
- (b) Arthritis / Spondylosis.
  - (i) Rheumatoid arthritis and allied disorders.
  - (ii) Ankylosing Spondylitis.
  - (iii) Osteoarthritis, spondylosis and degenerative joint disease.
  - (iv) Non-articular rheumatism (e.g. lesions of the rotator cuff, tennis elbow, recurrent lumbago etc.)

- (v) Misc disorders including SLE, Polymyositis, and Vasculitis.
- (vi) Spondylolisthesis / spondylolysis
- (vii) Compression fracture of Vertebra
- (viii) Scheuerman's Disease (Adolescent Kyphosis)
- (ix) Loss of cervical lordosis when associated with clinically restricted movements of cervical spine.
- (x) Unilateral / Bilateral Cervical ribs with demonstrable neurological or circulatory deficit.
- (xi) Any other abnormality is so considered by the specialist.

1.9.6. Fitness for Flying Duties. ***The deformities/disease contained in para 1.9.5 above will be cause of rejection for all branches in IAF.*** In addition for candidates for flying branches the under mentioned rules will also apply: -

(a) Spinal anomalies acceptable for flying duties: -

- (i) Bilateral complete sacralisation of LV5 and bilateral complete lumbarisation of SV1.
- (ii) Spine bifida in sacrum and in LV5, if completely sacralised.
- (iii) Complete block (fused) vertebrae in cervical and /or dorsal spine at a single level.

**Note:** However, an annotation will be made of these anomalies in AFMSF-2.

(b) Spinal conditions not acceptable for flying duties.

- (i) Scoliosis more than 15 degree as measured by Cobb's method.
- (ii) Degenerative disc disease.
- (iii) Presence of Schmorl's nodes at more than one level.
- (iv) Atlanto - occipital and atlanto-axial anomalies.
- (v) Hemi vertebra and/or incomplete block (fused) vertebra at any level in cervical, dorsal or lumbar spine and complete block (fused) vertebra at more than one level in cervical or dorsal spine.
- (vi) Unilateral sacralisation or lumbarisation (complete or incomplete) at all levels and bilateral incomplete sacralisation or lumbarisation.

### **Conditions affecting the assessment of Upper Limbs**

1.9.7. Amputations. Candidate with an amputation of an upper limb will not be accepted for entry. Amputation of terminal

phalanx of little finger on both sides is, however, acceptable

1.9.8. Fingers and Hands. Deformities of the upper limbs or their parts will be cause for rejection. Syndactyly, polydactyly will be assessed as unfit except when polydactyly is excised.

1.9.9. Wrist. Painless limitation movement of wrist will be graded according to the degree of stiffness. Loss of dorsiflexion is more serious than loss of palmer flexion.

1.9.10. Elbow. Slight limitation of movement does not bar acceptance provided functional capacity is adequate. Ankylosis will entail rejection. Carrying angle of more than 15 degree for male and more 18 degree for female candidates will be a cause for rejection.

1.9.11. Shoulder Girdle. History of recurrent dislocation of shoulder will entail rejection.

1.9.12. Clavicle. Malunion / non-union of an old fracture clavicle will entail rejection.

### **Conditions affecting the assessment of Lower Limbs**

1.9.13. Hallux Valgus. Mild cases (less than 20 degrees), asymptomatic, without any associated corn / callosities / bunion, are acceptable. Other cases will entail rejection. Shortening of first metatarsal is also considered unfit.

1.9.14. Hallux rigidus. Hallux rigidus is not acceptable.

1.9.15. Hammer Toes (single or multiple). Isolated single flexible mild hammertoe with no history of disabling symptoms may be accepted. Fixed (rigid) deformity or hammertoe associated with corns, callosities, mallet toes or hyperextension at metatarsophalangeal joint (claw toe deformity) is causes for rejection.

1.9.16. Loss of Digits. Loss of any digit of the toes or fingers entails rejection.

1.9.17. Extra Digits. Extra digits will entail rejection if there is bony continuity with adjacent digits. Cases of syndactyly or loss of toes/fingers will be rejected.

1.9.18. Flat feet. Feet may look apparent flat. If the arches of the feet reappear on standing on toes, if the candidate can skip and run well on the toes and if the feet are supple, mobile and painless, the candidate is acceptable. Restriction of the movements of the foot will also be a cause for rejection. Rigidity of the foot, whatever may be the shape of the foot, is a cause for rejection.

1.9.19. **Pes Cavus and Talipes (Club Foot)**. Mild degree of idiopathic pes cavus is acceptable. Moderate and severe pes cavus and pes cavus due to organic disease will entail rejection. All cases of Talipes (Club Foot) will be rejected.

1.9.20. **The Ankle Joints**. Any significant limitation of movement following previous injuries will not be accepted. However, cases with no history of recurrent trouble and having plantar and dorsiflexion movement of at least 20 degree may be assessed fit for ground duties. Fitness for aircrew duties will be based on functional evaluation.

1.9.21. **The Knee Joint**. History or clinical signs suggestive of Internal Derangement of Knee will need careful consideration. Fitness in such cases will be based on functional evaluation and possibility/progression/recurrence of the

treated pathology.

1.9.22. **Genu Valgum (Knock Knee)**. If the distance between the internal malleoli is less than 5 cm, without any other deformity, the candidate is considered fit. If the distance between the two internal malleoli is more than 5 cm, he should be declared unfit.

1.9.23. **Genu Varum (Bow Legs)**. If the distance between the femoral condyles is within 10 cm the candidate should be considered fit.

1.9.24. **Genu Recurvatum**. If the hyperextension of the knee is within 10 degrees and is unaccompanied by any other deformity, the candidate should be accepted as fit.

1.9.25. **Hip Joint**. True lesions of the hip joint will entail rejection.

## CHAPTER 10

### CENTRAL NERVOUS SYSTEM

#### **Relevant Personal History**

1.10.1. **Mental Illness**. A candidate giving a history of mental illness/psychological afflictions requires detailed investigation and psychiatric referral. Such cases should normally be rejected. Most often the history is not volunteered. The examiner should try to elicit a history by direct questioning, which may or may not be fruitful. *Every examiner should form a general impression of the candidate's personality as a whole and may enquire into an individual's stability and habitual reactions to difficult and stressful situations.*

1.10.2. **Insomnia, Nightmare, Sleepwalking or bed-wetting**. History of insomnia, nightmares or frequent sleepwalking, when recurrent or persistent, will be a cause for rejection.

1.10.3 **Severe or 'throbbing' Headache and Migraine**. Common types of recurrent headaches are those due to former head injury or migraine. Other forms of occasional headache must be considered in relation to their probable cause. A candidate with migraine, which was severe enough to make him consult his doctor, should normally be a cause for rejection. Even a single attack of migraine with visual disturbance or 'Migrainous epilepsy' is a bar to acceptance.

1.10.4. **Fits and convulsions**. History of epilepsy in a candidate is a cause for rejection. Convulsions/fits after the age of five are also a cause for rejection. Convulsions in infancy may not be of ominous nature provided it appears that the convulsions were febrile convulsions and were not associated with any overt neurological deficit. Causes of epilepsy include genetic factors, traumatic brain injury, stroke, infection, demyelinating and degenerative disorders, birth defects, substance abuse and withdrawal seizures. Enquiry should not be limited only to the occurrence of major attacks. Complex Partial seizures may masquerade as "faints" and therefore the frequency and the conditions under which "faints" took place must be elicited. Such attacks indicate unsuitability for flying, whatever their apparent nature. An isolated fainting attack calls for enquiry into all the attendant factors to distinguish between syncope and seizures. For e.g. fainting in school is of common occurrence and may have little significance. Other complex partial seizures may manifest as vegetative movements as lip smacking, chewing, staring, dazed appearance and periods of unresponsiveness. In any event, a prolonged period of freedom from recurrence must have elapsed before fitness for flying duties can be considered and if the electroencephalogram does not show any specific abnormality.

**1.10.5. Heat stroke.** History of repeated attacks of heat stroke, hyperpyrexia or heat exhaustion bars employment for air force duties, as it is an evidence of a faulty heat regulating mechanism. A single severe attack of heat effects, provided the history of exposure was severe, and no permanent sequelae were evident is, by itself, not a reason for rejecting the candidate.

**1.10.6. Head Injury or Concussion.** A history of severe head injury is a cause for rejection. The degree of severity may be gauged from the history of duration of Post Traumatic Amnesia (PTA). Mild brain injury is associated with 0-1 hour PTA, moderate with 1 – 24 hours PTA, severe with 1-7 days PTA and very severe with > 7 days of PTA. Other sequelae of head injury are post concussion syndrome which has subjective symptoms of headache, giddiness, insomnia, restlessness, irritability, poor concentration and attention deficits; focal neurological deficit, posttraumatic epilepsy and posttraumatic neuropsychological impairment which includes deficits in attention concentration, information processing speeds, mental flexibility and frontal lobe executive functions and psychosocial functioning. Neuropsychological testing including psychometry can assess these aspects. It is important to realize that sequelae may persist for considerable period and may even be permanent. Fracture of the skull need not be a cause for rejection unless there is a history of associated intracranial damage or of depressed fracture or loss of bone. When there is a history of severe injury or an associated convulsive attack, an electroencephalogram should be carried out which must be normal. Presence of burr holes will be cause for rejection for flying duties, but not for ground duties. Each case is to be judged on individual merits. Opinion of neurosurgeon and psychiatrist must be obtained before acceptance.

### **Family History**

**1.10.7. History of Psychological Disorders.** When a history of nervous break down, mental disease, of suicide of a near relative is obtained, a careful investigation of the personal past history from a psychological point of view is to be obtained. While such a history per se is not a bar to air force duties any evidence of even the slightest psychological instability, in the personal history or present condition, should entail rejection.

**1.10.8. Epilepsy.** If a family history of epilepsy is admitted an attempt should be made to determine its type. When the condition has occurred in a near (first degree) relative, the candidate may be accepted, if he has no history of associated disturbance of consciousness, neurological deficit or higher mental functions and his electroencephalogram is completely normal.

**1.10.9. Emotional Stability.** The assessment of emotional stability the must include family and personal history, any indication of emotional liability under stress as evidenced by the occurrence of undue emotionalism as a child or of any previous nervous illness or breakdown. The presence of stammering, tic, nail biting, excessive hyperhydrosis or restlessness during examination could be indicative of emotional instability.

**1.10.10. Psychosis.** All candidates who are suffering from psychosis are to be rejected. Drug dependence in any form will also be a cause for rejection.

**1.10.11. Psychoneurosis.** Mentally unstable and neurotic individuals are unfit for commissioning. Juvenile and adult delinquency, history of nervous breakdown or chronic ill health are causes for rejection. Particular attention should be paid to such factors as unhappy childhood, poor family background, truancy, juvenile and adult delinquency, poor employment and social maladjustment records, history of nervous break down or chronic ill-health, particularly if these have interfered with employment in the past.

**1.10.12. Organic Nervous Conditions.** Any evident neurological deficit should call for rejection.

**1.10.13. Tremors.** Tremors are rhythmic oscillatory movements of reciprocally innervated muscle groups. Two categories are recognized: normal or physiologic and abnormal or pathologic. Fine tremor is present in all contracting muscle groups, it persists throughout the waking state, the movement is fine between 8 to 13 Hz. Pathologic tremor is coarse, between 4 to 7 Hz and usually affects the distal part of limbs. Gross tremors are generally due to enhanced physiological causes where, at the same frequency, the amplitude of the tremor is grossly enhanced and is elicited by outstretching the arms and fingers which are spread apart. This occurs in cases of excessive fright, anger, anxiety, intense physical exertion, metabolic disturbances including hyperthyroidism, alcohol withdrawal and toxic effects of lithium, smoking (nicotine) and excessive tea, coffee. Other causes of coarse tremor are parkinsonism, cerebellar (intention) tremor, essential (familial) tremor, tremors of neuropathy and postural or action tremors.

**1.10.14. Stammering.** *Candidates with stammering will not be accepted for air force duties. Careful assessment by ENT Specialist, Speech therapist, psychologist/ psychiatrist may be required.*

**1.10.15. Basal E.E.G.** Only those candidates for aircrew duties will be subjected to EEG examination as specified in para 2.9.13. Those with following EEG abnormalities in resting EEG or EEG under provocative techniques will be rejected for aircrew duties: -

- (a) **Background Activity.** Focal, excessive and high amplitude beta activity /hemispherical asymmetry of more than 2.3 Hz/generalized and focal runs of slow waves approaching background activity in amplitude.
- (b) **Hyperventilation.** Paroxysmal spikes and slow waves/spikes/focal spike pattern
- (c) **Photo Stimulation.** Bilaterally synchronous or focal paroxysmal spikes and slow waves persisting in post-photic stimulation period/suppression or driving response over one hemisphere.

**1.10.16.** Non specific EEG abnormality will be acceptable provided opinion of Neuropsychiatrist / Neurophysician is obtained. The findings of EEG will be entered in AFMSF-2.

## CHAPTER 11

### EAR, NOSE AND THROAT

**1.11.1. Nose and paranasal sinuses.**

- (a) Obstruction to free breathing as a result of a marked septal deviation is a cause for rejection. Post correction surgery with residual mild deviation with adequate airway will be acceptable.
- (b) Any septal perforation will entail rejection.
- (c) Atrophic rhinitis entails rejection.
- (d) Cases of allergic rhinitis will entail rejection for flying duties.
- (e) Any infection of para-nasal sinuses will be a cause for temporary rejection. Such cases may be accepted

following successful treatment.

(f) Multiple polyposis is a cause for rejection.

#### 1.11.2. Oral Cavity and Throat.

(a) Candidates where tonsillectomy is indicated will be temporarily rejected. Such candidates may be accepted after successful surgery.

(b) The presence of a cleft palate is a cause for rejection.

(c) Any disabling condition of the pharynx or larynx including persistent hoarseness of voice will entail rejection.

1.11.3. Eustachian Tube Dysfunction. Obstruction or insufficiency of eustachian tube function will be a cause for rejection. Altitude chamber ear clearance test will be carried out before acceptance for aircrew duties.

1.11.4. Tinnitus. The presence of tinnitus necessitates investigation of its duration, localization, severity and possible causation. Persistent tinnitus is a cause for rejection, as it is liable to become worse through exposure to noise and may be a precursor to Otosclerosis and Meniere's disease.

1.11.5. Susceptibility to Motion Sickness. Specific enquiry should be made for any susceptibility to motion sickness. An endorsement to this effect should be made in AFMSF-2. ***Such cases will be fully evaluated and, if found susceptible to motion sickness, they will be rejected for flying duties.***

1.11.6. A candidate with a history of dizziness is unsuitable for employment on flying duties.

#### 1.11.7. Hearing loss.

(a) Free field hearing loss is a cause for rejection.

(b) Audiometric loss should not be greater than 20 db, in frequencies between 250 and 4000 Hz. In evaluating the audiogram, the baseline zero of the audiometer and the environmental noise conditions under which the audiogram has been obtained should be taken into consideration. On the recommendation of an ENT Specialist, an isolated unilateral hearing loss up to 30 db may be condoned provided ENT examination is otherwise normal.

1.11.8. Ears. A radical / modified radical mastoidectomy, or a fenestration operation entails rejection even if completely epithelialised and good hearing is preserved. Cases of cortical mastoidectomy in the past with the tympanic membrane intact and presenting no evidence of disease may be accepted.

1.11.9. External Ear. Cases of chronic otitis externa accompanied by exostoses or unduly narrow meatii should be rejected. Exaggerated tortuosity of the canal, obliterating the anterior view of the Tympanic Membrane will be a cause for rejection.

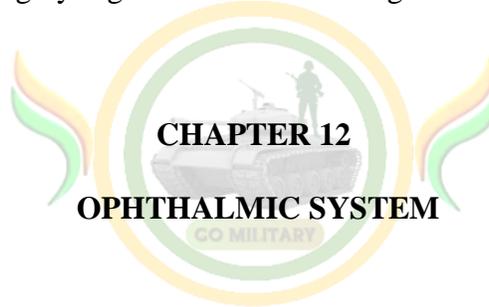
1.11.10. Middle Ear. Tympanoplasty type I is acceptable twelve weeks after surgery, provided ear clearance test in altitude chamber is normal. The following middle ear conditions will entail rejection:-

(a) Attic, central or marginal perforation.

- (b) Tympanic membrane scar with marked retraction.
- (c) Tympanoplasty type II onward but not type I
- (d) Calcareous plaques (tympanosclerosis) if occupying more than 1/3 of pars tensa.
- (e) Middle ear infections.
- (f) Granulation or polyp.
- (g) Stapedectomy/ Stapedolysis operation.

1.11.11. Miscellaneous Ear conditions. The following ear conditions will entails rejection:-

- (a) Otosclerosis even if successfully operated.
- (b) Meniere's disease.
- (c) Vestibular Dysfunction including nystagmus of vestibular origin.
- (d) Bell's palsy.



**1.12.1.** Visual defects and medical ophthalmic conditions are amongst the major causes of rejection for flying duties. Therefore, a thorough and accurate eye examination is of great importance in selecting flying personnel.

1.12.2. Personal and Family History and External Examination.

- (a) Squint and the need for spectacles for other reasons are frequently hereditary and a family history may give valuable information on the degree of deterioration to be anticipated. Candidates, who are wearing spectacles or found to have defective vision, should be properly assessed.
- (b) Ptosis interfering with vision or visual field is a cause for rejection till surgical correction remains successful for a period of six months. Candidates with uncontrollable blepharitis, particularly with loss of eyelashes, are generally unsuitable and should be rejected. Severe cases of blepharitis and chronic conjunctivitis should be assessed as temporarily unfit until the response to treatment can be assessed.
- (c) Naso-lachrymal occlusion producing epiphora or a mucocele entails rejection, unless surgery produces relief lasting for a minimum of six months.

(d) Uveitis (iritis, cyclitis, and choroiditis) is frequently recurrent, and candidates giving a history of or exhibiting this condition should be carefully assessed. When there is evidence of permanent lesions such candidates should be rejected.

(e) Cornea - corneal scars, opacities will be cause for rejection unless it does not interfere with vision. Such cases should be carefully assessed before acceptance, as many conditions are recurrent.

(f) Cases with Lenticular opacities should be assessed carefully. As a guideline any opacity causing visual deterioration, or is in the visual axis or is present in an area of 7 mm around the pupil, which may cause glare phenomena, should not be considered fit. The propensity of the opacities not to increase in number or size should also be a consideration when deciding fitness.

(g) Visual disturbances associated with headaches of a migrainous type are not a strictly ocular problem, and should be assessed in accordance with para 3.10.3 and 3.10.4. Presence of diplopia or detection of nystagmus requires proper examination, as they can be due to physiological reasons.

(h) Night blindness are largely congenital but certain diseases of the eye exhibit night blindness as an early symptom and hence, proper investigations are necessary before final assessment. As tests for night blindness are not routinely performed, a certificate to the effect that the individual does not suffer from night blindness will be obtained in every case. Certificate should be as per Appendix "A" to this chapter.

(j) Restriction of movements of the eyeball in any direction and undue depression/ prominence of the eyeball requires proper assessment.

1.12.3. Visual Acuity/Colour Vision. The visual acuity and colour vision requirements are detailed in Appendix B to this chapter. Those who do not meet these requirements are to be rejected.

1.12.4. Myopia. If there is a strong family history of Myopia, particularly if it is established that the visual defect is recent, if physical growth is still expected, or if the fundus appearance is suggestive of progressive myopia, even if the visual acuity is within the limit prescribed, the candidate should be declared unfit.

1.12.5. Ophthalmic Surgeries. Radial Keratotomy, Photo Refractive Keratotomy / Laser in Situ Keratomileusis (PRK/LASIK) surgeries for correction of refractive errors are not permitted for any air force duties. Corneal Topography may be done in suspected cases. Candidates having undergone cataract surgery with or without IOL implants will also be declared unfit.

### **Ocular Muscle Balance**

1.12.6. Individuals with manifest squint are not acceptable for commissioning.

1.12.7. The assessment of latent squint or heterophoria in the case of aircrew will be mainly based on the assessment of the fusion capacity. A strong fusion sense ensures the maintenance of binocular vision in the face of stress and fatigue. Hence, it is the main criterion for acceptability.

(a) **Convergence**

(i) **Objective Convergence**. Average is from 6.5 to 8 cm. It is poor at 10 cm and above.

(ii) **Subjective Convergence (SC)**. This indicates the end point of binocular vision under the stress of convergence. If the subjective convergence is more than 10 cm beyond the limit of objective convergence, the fusion capacity is poor. This is specially so when the objective convergence is 10 cm and above.

(b) **Accommodation**. In the case of myopes accommodation should be assessed with correcting glasses in position. The acceptable values for accommodation in various age groups are given in Table 1.

**Table 1. Accommodation Values - Age wise.**

<b>Age in years</b>	17-20	21-25	26-30	31-35	36-40	41-45
<b>Accommodation</b>	10-11	11-12	12.5-13.5	14-16	16-18.5	18.5-27

**in cm.**

**1.12.8.** Ocular muscle balance is dynamic and varies with concentration, anxiety, fatigue, hypoxia, drugs and alcohol. The above tests should be considered together for the final assessment. For example, cases just beyond the maximum limits of the Maddox Rod test, but who show a good binocular response, a good objective convergence with little difference from subjective convergence, and full and rapid recovery on the cover tests may be accepted. On the other hand, cases well within Maddox Rod test limits, but who show little or no fusion capacity, incomplete or no recovery on the cover tests, and poor subjective convergence should be rejected. Standards for assessment of Ocular Muscle Balance are detailed in Appendix C to this chapter.

**1.12.9.** Any clinical findings in the media (Cornea, Lens, Vitreous) or fundus, which is of pathological nature and likely to progress will be a cause for rejection. This examination will be done by slit lamp and ophthalmoscopy under mydriasis.

**Appendix A**

(Refers to para 1.12.2(h))

**CERTIFICATE REGARDING NIGHT BLINDNESS**

Name with initials \_\_\_\_\_

Batch No. \_\_\_\_\_ Chest No \_\_\_\_\_

I hereby certify that to the best of my knowledge, there has not been any case of night blindness in our family, and I do not suffer from it.

Date. ....

(Signature of the candidate)



(Name of Medical Officer)

## Appendix B

(Refers to Para 1.12.3)

### VISUAL STANDARDS

#### OFFICERS, CADETS AND AIRMEN AIRCREW AT INITIAL ENTRY

Sl No	Med Cat	Branch	Maximum limits of refractive	Visual acuity errors	Color Vision
1.	A1G1	F (P)	Hypermetropia: + 2.0D Sph <b>Manifest Myopia:</b> Nil <b>Retinoscopic myopia:</b> - 0.5 in any meridian permitted <b>Astigmatism:</b> + 0.75D Cyl (within + 2.0 D – Max)	6/6 in one eye and 6/9 in other, correctable to 6/6 only for Hypermetropia	CP-I
2.	A1G1	Aircrew other than F(P)	Hypermetropia: +3.5D Sph <b>Myopia:</b> - 2.0D Sph <b>Astigmatism:</b> + 0.75D Cyl	6/24 in one eye and 6/36 in other, correctable to 6/6 and 6/9.	CP-I
3.	A4G1	ATC	Hypermetropia: + 2.0D Sph <b>Myopia:</b> - 0.5D Sph <b>Astigmatism:</b> + 0.5D Cyl	A minimum to 6/9 in each eye correctable to 6/6 in each eye. Wearing of glasses will be compulsory when visual acuity is below 6/6	CP-II
4.	A4G1	Fighter Controller	Hypermetropia:+ 3.0D Sph <b>Myopia:</b> –2.0D Sph <b>Astigmatism:</b> + 1.50D Cyl	A minimum to 6/36 in each eye. Correctable to 6/6 in each eye wearing of glasses will be compulsory when binocular acuity is below 6/6	CP-III

5.	A4G1	AE(M) AE(L)	Hypermetropia: + 3.5 D SphMyopia: -3.50 D Sph Astigmatism: + 2.50 D Cyl	Corrected visual acuity should be 6/9 in each eye. Wearing of glasses will be compulsory when advised	CP-II
6.	A4G1	Met	Hypermetropia: + 3.5 D SphMyopia: -3.50 D Sph Astigmatism: + 2.50 D Cyl	Corrected visual acuity should be 6/6 in the better eye and 6/18 in the worse eye. Wearing of Glasses will be compulsory.	CP-II
7.	A4G1	Adm/ Accts/ Lgs	Hypermetropia: + 3.5 D SphMyopia: -3.50 D Sph Astigmatism: + 2.50 D Cyl		CP-III
8.	A4G1	Medica l/ Dental	Hypermetropia: + 3.5 D SphMyopia: -5.50 D Sph Astigmatism: + 2.50 D Cyl		CP-III

**Note 1.** Ocular muscle balance for personnel covered in Sl. Nos. 1 and 2 should conform to Appendix C to this Chapter.

**Note 2.** Visual standards of Air Wing Cadets at NDA and Flt Cdts of F (P) at AFA should conform to A1G1 F (P) standard (Sl. No. 1 of Appendix B)

**Note 3.** The Sph correction factors mentioned above will be inclusive of the specified astigmatic correction factor.

### Appendix C

(Refers to para 1.12.8)

#### STANDARD OF OCULAR MUSCLE BALANCE FOR FLYING DUTIES

Sl No	Test	Fit	Temporary Unfit	Permanently Unfit
1.	Maddox Rod Test at 6 meters	Exo-6 Prism D Eso -6 Prism D	Exo- Greater than 6 prism D Eso- Greater than 6 prism D	Uniocular suppression Hyper/Hypo

		Hyper-1 Prism D	Hyper- Greater than 1 prism D	more than 2 prism D
		Hypo- 1 prism D	Hypo- Greater than 1 prism D	
2.	Maddox Rod Test at 33 D cm	Exo-16 Prism D	Exo - Greater than 16 prism D	Unocular suppression
		Eso- 6 Prism D	Eso - Greater than 6 prism D	Hyper/Hypo
		Hyper- 1 Prism D	Hyper Greater than 1 prism D	more than 2 prism D
		Hypo- 1 Prism D	Hypo Greater than 1 prism D	
3.	Hand held Stereoscope	All of BSV grades	Poor Fusional reserves	Absence of SMP, fusion Stereopsis
4.	Convergence	Up to 10 cm	Up to 15 cm with effort	Greater than 15 cm with effort
5.	Cover test For distance And near	Lateral divergence/ convergence recovery rapid and complete	Compensated heterophoria/ trophia likely to improve with treatment likely to improve / persisting even after treatment	Compensated heterophoria

## CHAPTER 13

### HAEMOPOIETIC SYSTEM

**1.13.1.** All candidates will be examined for clinical evidence of pallor (anaemia), malnutrition, icterus, peripheral lymphadenopathy, purpura, petechiae/ecchymoses and hepatosplenomegaly.

**1.13.2.** In the event of laboratory confirmation of anaemia (<13g/dl in males and <11.5g/dl in females), further evaluation to ascertain type of anaemia and aetiology has to be carried out. This should include a complete haemogram (to include the PCV MCV, MCH, MCHC, TRBC, TWBC, DLC, Platelet count, reticulocyte count & ESR) and a peripheral blood smear. All the other tests to establish the aetiology will be carried out, as required. Ultrasonography of abdomen for gallstones, upper GI Endoscopy/ proctoscopy and hemoglobin electrophoresis etc may be done, as indicated, and the fitness of the

candidate, decided on the merit of each case.

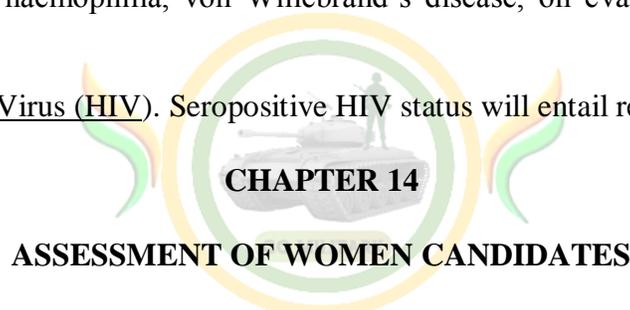
**1.13.3.** Candidates with mild microcytic hypochromic (Iron deficiency anaemia) or dimorphic anaemia (Hb < 10.5 g/dl in females and < 11.5g/dl in males), in the first instance, may be made temporarily unfit for a period of 04 to 06 weeks followed by review thereafter. These candidates can be accepted, if the complete haemogram and PCV, peripheral smear results are within the normal range. Candidates with macrocytic / megaloblastic anaemia will be assessed unfit.

**1.13.4.** All candidates with evidence of hereditary haemolytic anaemias (due to red cell membrane defect or due to red cell enzyme deficiencies) and haemoglobinopathies (Sickle cell disease, Beta Thalassaemia: Major, Intermedia, Minor, Trait and Alpha Thalassaemia etc) are to be considered unfit for service.

**1.13.5.** In the presence of history of haemorrhage into the skin like ecchymosis / petechiae, epistaxis, bleeding from gums and alimentary tract, persistent bleeding after minor trauma or lacerations / tooth extraction or menorrhagia in females and any family history of haemophilia or other bleeding disorders a full evaluation will be carried out. These cases will not be acceptable for entry to service. All candidates with clinical evidence of purpura or evidence of thrombocytopenia are to be considered unfit for service. Cases of Purpura Simplex (simple easy bruising), a benign disorder seen in otherwise healthy women, may be accepted.

**1.13.6.** Candidates with history of haemophilia, von Willebrand's disease, on evaluation, are to be declared unfit for service at entry level.

**1.13.7.** Human Immuno Deficiency Virus (HIV). Seropositive HIV status will entail rejection.



**1.14.1 History.** Detailed menstrual and obstetric history, in addition to general medical history, must be taken and recorded as outlined in para 2.13.2. If a history of menstrual, obstetric or pelvic abnormality is given; an opinion of gynaecologist is to be obtained

### **Examination**

#### **1.14.2. General Medical and Surgical Standards**

(a) Any lump in the breast will be a cause for rejection. Cases of Fibroadenoma breast after successful surgical removal may be considered fit with the opinion of a surgical specialist.

(b) Galactorrhoea will be cause for temporary unfitness. Fitness after investigation/treatment may be considered based on merits of the case and opinion of the concerned specialist.

#### **1.14.3. Gynaecological Disorders**

(a) Any abnormality of external genitalia will be considered on merits of each case. Significant Hirsutism especially with male pattern of hair growth will be a cause for rejection. Doubtful cases if any will be decided based on the opinion of the specialists.

(b) A detailed pelvic sonography will be conducted. If any abnormality is detected, the candidate will be examined by the concerned specialist. Following conditions will not be a cause for rejection:-

(i) Small fibroid uterus (3 cm or less in diameter) without symptoms.

(ii) Small ovarian cyst (3 cm or less in diameter) as such cysts are invariably functional.

(iii) Congenital elongation of cervix (which comes up to introitus).

(iv) Congenital uterine anomalies such as bicornuate uterus, uterus didelphys and arcuate uterus.

(c) Acute or chronic pelvic infection and Endometriosis will be causes for rejection.

(d) Severe menorrhagia will entail rejection, since it is likely to interfere with work ability. Amenorrhoea without pregnancy will be investigated and fitness will be considered on merits after examination and investigation by gynaecologist.

(e) Complete prolapse of uterus will be a cause for rejection. Minor degree, after surgical correction, may be considered for fitness on merits.

(f) Any other gynaecological condition not covered above will be considered on merits of each case by gynecologist.

(g) Pregnancy will be a cause for rejection during commissioning for all branches other than medical and dental, where temporary unfitness will be given till 24 weeks after delivery.

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## HbA1C

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## The Hemoglobin A1c (HbA1c) Test for Diabetes

### Importance of Hemoglobin A1c Test

The hemoglobin A1c test - also called HbA1c, glycated hemoglobin test, or glycohemoglobin -- is an important blood test used to determine how well your diabetes is being controlled. Hemoglobin A1c provides an average of your blood sugar control over a six to 12 week period and is used in conjunction with home blood sugar monitoring to make adjustments in your diabetes medicines.

Hemoglobin is a substance within red blood cells that carries oxygen throughout your body. When your diabetes is not controlled (meaning that your blood sugar is too high), sugar builds up in your blood and combines with your hemoglobin, becoming "glycated." Therefore, the average amount of sugar in your blood can be determined by measuring a hemoglobin A1c level. If your glucose levels have been high over recent weeks, your hemoglobin A1c test will be higher. The amount of hemoglobin A1c will reflect the last several weeks of blood sugar levels, typically

encompassing a period of 120 days.

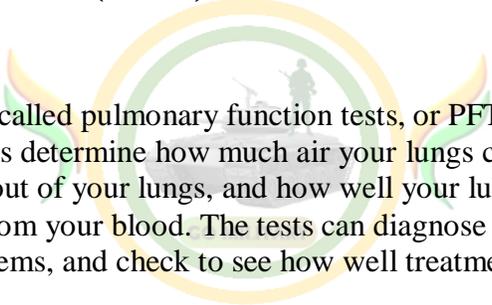
## What's a Normal Hemoglobin A1c Test?

For people without diabetes, the normal range for the hemoglobin A1c test is between 4% and 6%. Because studies have repeatedly shown that out-of-control diabetes results in complications from the disease, the goal for people with diabetes is an hemoglobin A1c less than 7%. The higher the hemoglobin A1c, the higher the risks of developing complications related to diabetes.

People with diabetes should have this test every three months to determine whether their blood sugars have reached the target level of control. Those who have their diabetes under good control may be able to wait longer between the blood tests, but experts recommend checking at least 2 times a year.

Patients with diseases affecting hemoglobin such as anemia may get abnormal results with this test. Other abnormalities that can affect the results of the hemoglobin A1c include supplements such as vitamins C and E and high cholesterol levels. Kidney disease and liver disease may also affect the result of the hemoglobin A1c test.

## Lung Function Test (PFT)



Lung function tests (also called pulmonary function tests, or PFTs) evaluate how well your lungs work. The tests determine how much air your lungs can hold, how quickly you can move air in and out of your lungs, and how well your lungs put oxygen into and remove carbon dioxide from your blood. The tests can diagnose lung diseases, measure the severity of lung problems, and check to see how well treatment for a lung disease is working.

Other tests such as residual volume, gas diffusion tests, body plethysmography, inhalation challenge tests, and exercise stress tests may also be done to determine lung function.

**Spirometry** is the first lung function test done. It measures how much and how quickly you can move air out of your lungs. For this test, you breathe into a mouthpiece attached to a recording device (spirometer). The information collected by the spirometer may be printed out on a chart called a spirogram.

The more common lung function values measured with spirometry are:

- **Forced vital capacity (FVC)**. This measures the amount of air you can exhale with force after you inhale as deeply as possible.
- **Forced expiratory volume (FEV)**. This measures the amount of air you can exhale with force in one breath. The amount of air you exhale may be measured at 1 second (FEV1), 2 seconds (FEV2), or 3 seconds (FEV3). FEV1 divided by FVC can also be determined.

- **Forced expiratory flow 25% to 75%.** This measures the air flow halfway through an exhale (FVC).
- **Peak expiratory flow (PEF).** This measures how quickly you can exhale. It is usually measured at the same time as your forced vital capacity (FVC).
- **Maximum voluntary ventilation (MVV).** This measures the greatest amount of air you can breathe in and out during one minute.
- **Slow vital capacity (SVC).** This measures the amount of air you can slowly exhale after you inhale as deeply as possible.
- **Total lung capacity (TLC).** This measures the amount of air in your lungs after you inhale as deeply as possible.
- **Functional residual capacity (FRC).** This measures the amount of air in your lungs at the end of a normal exhaled breath.
- **Expiratory reserve volume (ERV).** This measures the difference between the amount of air in your lungs after a normal exhale (FRC) and the amount after you exhale with force (RV).

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## Ophthalmoscopy

Ophthalmoscopy is a test that allows a health professional to see inside the back of the eye (called the fundus) and other structures using a magnifying instrument (ophthalmoscope) and a light source. It is done as part of an eye examination and may be done as part of a routine physical examination.

The fundus contains a lining of nerve cells (the retina), which detects images seen by the clear, outer covering of the eye (cornea). The fundus also contains blood vessels and the optic nerve. See a picture of the structures of the eye.

**There are two types of ophthalmoscopy.**

- **Direct ophthalmoscopy.** Your health professional uses an instrument about the size of a small flashlight with several lenses that can magnify up to about 15 times. This type of ophthalmoscopy is most commonly done during a routine physical examination.
- **Indirect ophthalmoscopy.** Your health professional wears a light attached to a headband and uses a small handheld lens. Indirect ophthalmoscopy provides a wider view of the inside of the eye and allows a better view of the fundus even if the lens is clouded by cataracts.

### **Why It Is Done**

Ophthalmoscopy is done to:

- Detect problems or diseases of the eye, such as retina problems.

- Help diagnose other conditions or diseases that damage the eye.
- Evaluate symptoms, such as headaches.
- Detect other problems or diseases, such as head injuries or brain tumors.

### **How To Prepare**

No special preparation is needed before having this test.

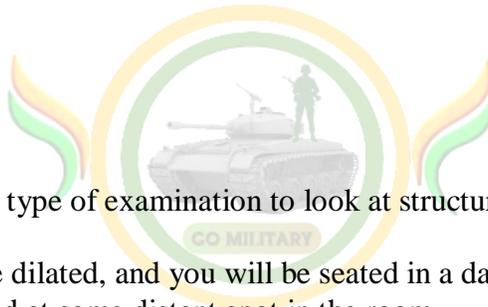
Your health professional may use eyedrops to widen (dilate) your pupils. This makes it easier to see the back of the eye. The eyedrops take about 15 to 20 minutes to dilate the pupil fully. Your health professional may also use eyedrops to numb the surface of your eyes. Tell your health professional if:

- You or anyone else in your family has glaucoma.
- You are allergic to dilating or anesthetic eyedrops.

You may have trouble focusing your eyes for several hours after the test. You may wish to arrange to have someone drive you home after the test. You also will need to wear sunglasses when you go outside or into a brightly lit room.

### **How It Is Done**

#### **Direct ophthalmoscopy**



This is the most common type of examination to look at structures inside the eye.

- Your eyes may be dilated, and you will be seated in a darkened room and asked to stare straight ahead at some distant spot in the room.
- Looking through the ophthalmoscope, your health professional will move very close to your face and shine a bright light into one of your eyes. Each eye is examined separately.
- Try to hold your eyes steady without blinking.

This examination takes 3 to 5 minutes. See a picture of a direct ophthalmoscopic examination.

#### **Indirect ophthalmoscopy**

This type of ophthalmoscopic examination gives a more complete view of the retina than direct ophthalmoscopy. It is usually done by an ophthalmologist.

- Your eyes will be dilated, and you will be asked to sit in a reclining or semi-reclining position in a darkened room.
- Your health professional will hold your eye open, shine a very bright light into it, and examine it through a special lens.

- Your health professional may ask you to look in different directions and may apply pressure to your eyeball through the skin of your eyelids with a small, blunt instrument to help bring the edges of your fundus into view.

This examination takes between 5 and 10 minutes. See a picture of an indirect ophthalmoscopic examination.

## How It Feels

### Direct ophthalmoscopy

During direct ophthalmoscopy, you may hear a clicking sound as the instrument is adjusted to focus on different structures in the eye. The light is sometimes very intense, and you may see spots for a short time following the examination. Some people report seeing light spots or branching images. These are actually the outlines of the blood vessels of the retina.

### Indirect ophthalmoscopy

With indirect ophthalmoscopy, the light is much more intense and may be somewhat uncomfortable. Pressure applied to your eyeball with the blunt instrument also may be uncomfortable. After-images are common with this test. If the test is painful, let the health professional know.

### When dilating eyedrops are used

Dilating drops may make your eyes sting and cause a medicine taste in your mouth. You will have difficulty focusing your eyes for up to 6 hours after your eyes have been dilated. Your distance vision usually is not affected as much as your near vision, though your eyes may be very sensitive to light. Do not drive for several hours after your eyes have been dilated. Wearing sunglasses may make you more comfortable until the effect of the drops wears off.

## Risks

In some people, the dilating or anesthetic eyedrops can cause:

- Brief episodes of nausea, vomiting, dry mouth, flushing, and dizziness.
- An allergic reaction.
- A sudden increase in pressure inside the eyeball (closed-angle glaucoma).

Call your health professional immediately if you have severe and sudden eye pain, vision problems (halos may appear around light), or loss of vision after the examination.

## Results

Ophthalmoscopy is a test that allows a health professional to see inside the back of the eye (called the fundus) and other structures using a magnifying instrument (ophthalmoscope) and a light source.

<b>Ophthalmoscopy</b>	
<b>Normal:</b>	<ul style="list-style-type: none"> <li>• All of the structures inside the eye appear normal. See a picture of a normal retina as seen through an ophthalmoscope.</li> </ul>
<b>Abnormal:</b>	<ul style="list-style-type: none"> <li>• The retina is detached.</li> <li>• Swelling of the optic nerve (papilledema) is found.</li> <li>• Optic nerve damage caused by glaucoma is found.</li> <li>• Changes in the retina (such as hard, white deposits beneath the retina called drusen, or broken blood vessels called hemorrhages) indicate macular degeneration.</li> <li>• Damaged blood vessels or bleeding in the back of the eye is seen. This could be caused by diseases such as high blood pressure or diabetes.</li> <li>• Cataracts are found.</li> </ul>

### What Affects the Test

Factors that can interfere with your test or the accuracy of the results include:

- The inability to remain still during the exam.
- Eye problems, such as incomplete pupil dilation, cataracts, or cloudiness of the liquid inside the eyeball.

### What To Think About

- Other eye tests may be done routinely along with ophthalmoscopy, including vision testing and tonometry testing for glaucoma. For more information, see the medical tests Vision Tests and Tonometry.
- Direct ophthalmoscopy is done more frequently than indirect ophthalmoscopy. Indirect ophthalmoscopy is a more difficult procedure and requires greater skill and more specialized equipment than direct ophthalmology, so it is generally done by ophthalmologists and optometrists.
- Indirect ophthalmoscopy has several advantages over direct ophthalmoscopy:
  - It allows better visualization of the inside of the eye when a cataract is present.
  - It provides a three-dimensional (3-D) view of the back of the eye, allowing a more detailed view of certain eye conditions (such as growths, optic nerve swelling, or retinal detachment).
  - It allows a wider view of the back of the eye than direct ophthalmoscopy.

- If your health professional suspects a problem with the blood vessels in your eye, a test called eye angiography may be done. This test uses fluorescein dye and a camera to photograph blood vessels in the eye. For more information, see the medical test Eye Angiogram.

## Prostate-Specific Antigen (PSA) Blood Test

Prostate-specific antigen (PSA) is a substance produced by the prostate gland. Elevated PSA levels may indicate prostate cancer or a noncancerous condition such as prostatitis or an enlarged prostate.

Most men have PSA levels under four (ng/mL) and this has traditionally been used as the cutoff for concern about risk of prostate cancer. Men with prostate cancer often have PSA levels higher than four, although cancer is a possibility at any PSA level. According to published reports, men who have a prostate gland that feels normal on examination and a PSA less than four have a 15% chance of having prostate cancer. Those with a PSA between four and 10 have a 25% chance of having prostate cancer and if the PSA is higher than 10, the risk increases to 67%.

In the past, most experts viewed PSA levels less than 4 ng/mL as normal. Due to the findings from more recent studies, some recommend lowering the cutoff levels that determine if a PSA value is normal or elevated. Some researchers encourage using less than 2.5 or 3 ng/mL as a cutoff for normal values, particularly in younger patients. Younger patients tend to have smaller prostates and lower PSA values, so any elevation of the PSA in younger men above 2.5 ng/mL is a cause for concern.

Just as important as the PSA number is the trend of that number (whether it is going up, how quickly, and over what period of time). It is important to understand that the PSA test is not perfect. Most men with elevated PSA levels have noncancerous prostate enlargement, which is a normal part of aging. Conversely, low levels of PSA in the bloodstream do not rule out the possibility of prostate cancer. However, most cases of early prostate cancer are found by a PSA blood test.

### **How Is The PSA Screening Test Done?**

The test involves drawing blood, usually from the arm. The results are usually sent to a laboratory and most often come back within several days.

### **When Should I Have My PSA Levels Tested?**

PSA blood tests and digital rectal exams should be done every year for men beginning at age 50, and earlier (age 40) for African American men and men with a family history of prostate cancer.

If your doctor is concerned that you might have prostate cancer based on either your PSA level or a rectal exam, a biopsy (a lab testing of a small amount of tissue from the prostate) will be this next step. This is the only way to positively identify the presence of cancer.

### **What Does an Elevated PSA Level Mean?**

Elevated PSA levels may indicate prostate cancer or a noncancerous condition such as prostatitis or an enlarged prostate.

Your PSA level can also be affected by other factors:

- **Age.** Your PSA will normally go up slowly as you age, even if you have no prostate problems.
- **Medications.** Some medicines may affect blood PSA levels. Tell your healthcare provider if you are taking finasteride (Proscar or Propecia) or dutasteride (Avodart). These drugs may falsely lower PSA levels typically by half of what it would normally be.

If your PSA level is high, your doctor may recommend that you get a prostate biopsy to determine if you have cancer.

### **Alternative PSA Testing**

There are some new PSA tests that may help you and your health care provider determine if you need a biopsy. You should know that doctors do not always agree on how to use or analyze the results of these additional tests.

- **Percent-free PSA.** PSA takes two major forms in the blood. One is attached, or bound, to blood proteins and the other circulates freely. The percent-free PSA test indicates how much PSA circulates free compared to the total PSA level. The percentage of free PSA is lower in men who have prostate cancer than in men who do not. Studies show that if your PSA results are in the borderline range (4 to 10), a low percent-free PSA (less than 10%) means that your likelihood of having prostate cancer is about 50% and that you should probably have a biopsy.

Many doctors recommend biopsies for men whose percent-free PSA is 20 or less.

- **PSA velocity.** The PSA velocity is not a separate test. Rather, it is the change in PSA levels over time. Even when the total PSA value isn't higher than 4, a high PSA velocity (an increase greater than 0.75 ng/mL in one year) suggests that cancer may be present and a biopsy should be considered.

### **Using the PSA Blood Test After Prostate Cancer Diagnosis**

Although the PSA test is used mainly to screen for prostate cancer, it is valuable in other situations:

- To guide treatment. Along with a doctor's examination and tumor grade, the PSA test can help determine how advanced a prostate cancer is. This may affect treatment options.
- To determine treatment success. After surgery or radiation, the PSA level can be monitored to help determine if treatment was successful. PSA levels normally fall to very low levels if the treatment removed or destroyed all of the cancer cells. A rising PSA level can mean that prostate cancer cells are present and your cancer has come back.

If you choose a "watchful waiting" approach to treatment, the PSA level can help determine if the disease is progressing and if active treatment should be considered.

During hormonal therapy, the PSA level can help indicate how well the treatment is working or when it may be time to try another treatment.

### **About Blood Tests**

#### **What is a blood test?**

Blood tests are a very useful diagnostic tool. Blood is made up of several different kinds of cells and other compounds, including various salts and certain proteins.

The liquid portion of the blood is called plasma. When blood clots outside the body, the blood cells and some of the proteins become solid. The remaining liquid is called serum, which can be used in chemical tests and in tests to find out how the immune system fights diseases.

Doctors can take blood samples and grow the infectious organisms that cause an illness to see exactly what they are through a microscope.

How is a blood test carried out?

Blood samples for testing can be taken either from a vein (which carries blood to the heart) or from an artery (which takes blood away from the heart).

If only a few drops of blood are needed (for monitoring blood sugar in diabetes, for example) it is enough to make a small prick in the tip of the finger and then squeeze the blood out.

Most blood tests are taken from a vein, commonly from those around the elbow. First a cord (tourniquet) is tied around the upper arm to make the vein prominent. It may be a bit tight, but this makes it much easier to take the test.

The site of the injection is then cleaned with spirit and then a needle is put into the vein. The needle will be attached either to a low pressure blood test bottle, or to a syringe where the plunger is pulled back to create low pressure. When the necessary amount of blood has been extracted, the needle is removed and a little ball of cotton wool is held over the wound. This should be pressed for one to two minutes before applying a sticking plaster.

If blood is taken from an artery, it is usually extracted from the wrist where there is an artery that is very close to the skin. This may be slightly uncomfortable, as the artery wall has more pain nerves in it than the vein wall.

After taking blood from an artery it may be necessary to hold a ball of cotton wool on the place where the injection was made for about five minutes to stop any bleeding.

Some people are very sensitive to needles and the sight of their own blood and may feel faint when a blood sample is taken. This is not uncommon and can be reduced by sitting or lying down while the sample is taken. If you feel faint or think that you might feel faint, immediately tell the person who is taking blood.

What do doctors examine in the blood?

Blood contains two main elements: the fluid that is called plasma and cells. There are three kinds of cells: red blood cells, white blood cells and platelets. To get the information they need from the blood, doctors actually do several tests with the blood sample. These include measurements of the levels of the cells and a blood smear. A blood smear is a film of blood placed on a slide to allow doctors to look at the individual cells under a microscope. These tests are listed below.

#### Red blood cells

One of the most important red blood cell tests is used to find out how much haemoglobin there is in the blood. Haemoglobin carries oxygen around your body. This is called the haemoglobin concentration or level.

Another important test, the mean corpuscular volume or MCV test, measures the size of the red blood cells.

If a person suffers from anaemia their haemoglobin level will always be less than normal. But the size of the red blood cells depends on the type of anaemia you have.

A haematocrit test measures the total volume that red blood cells take up in the blood. In practice, this is done by spinning a test tube of blood until the red blood cells - the heaviest part of the blood - go to the bottom of the tube. Then their volume is calculated.

Almost all types of anaemia will cause a low haematocrit (a low red blood cell

volume), as will very severe bleeding. A high haematocrit can occur if a person is dehydrated from not drinking enough fluid or because they are losing fluid as happens with diarrhoea, burns and sometimes surgery.

If the red blood cells are pale, it can be a sign of iron deficiency anaemia. If they have a strange shape, it may be because of sickle cell anaemia or pernicious anaemia.

Doctors also add stains to the blood smear to test the blood for parasites, for example in the case of sleeping sickness or malaria. They may also test for bacteria in the case of blood poisoning.

### White blood cells (WBC)

The doctor counts the total number of white blood cells and works out how many different types of white blood cells the patient has. This is called the differential WBC count.

The number of white blood cells may go up and this may be because of a bacterial infection, bleeding or a burn. More rarely the cause of a raised white count is due to leukaemia, cancer or malaria.

A person may lose white blood cells because they have autoimmune problems - this is where the antibodies that should fight diseases attack the body instead. Other reasons for loss of white blood cells include viral infections. More rarely, this can be a side effect of certain kinds of medication.

Doctors keep an eye on white blood cells to work out how a disease is changing. By monitoring the blood count in this way they can alter the patient's treatment as necessary.

### Platelets

Platelets are very small cells in the blood that clump together at sites of injury to blood vessels. They form the basis of the blood clot that would form if you cut yourself.

Low numbers of platelets can make a person vulnerable to bleeding, sometimes even without injury occurring. Causes of low platelet counts include autoimmune diseases where you produce an antibody to your own platelets, chemotherapy, leukaemia, viral infections and some medicines.

High numbers of platelets make a person more vulnerable to blood clots. High platelet counts are found in conditions involving the bone marrow such as leukaemia and cancer.

## Blood Sugar Levels

What is the blood sugar level?

The blood sugar level is the amount of glucose (sugar) in the blood. It is also known as plasma glucose level. It is expressed as millimoles per litre (mmol/l).

Normally blood glucose levels stay within narrow limits throughout the day: 4 to 8mmol/l. But they are higher after meals and usually lowest in the morning.

In diabetes the blood sugar level moves outside these limits until treated. Even with good control of diabetes, the blood sugar level will still at times drift outside this normal range.

Why control blood sugar levels?

When very high levels of blood glucose are present for years, it leads to damage of the small blood vessels.

This in turn increases your risk of developing late-stage diabetes complications including:

- retinopathy (eye disease)
- nephropathy (kidney disease)
- neuropathy (nerve disease)
- cardiovascular disease, such as heart attack, hypertension, heart failure, stroke and problems caused by poor circulation, eg gangrene in the worst cases.



With Type 1 diabetes, these complications may start to appear 10 to 15 years after diagnosis.

They frequently appear less than 10 years after diagnosis of Type 2 diabetes, because this type of diabetes is often present for years before it is recognised.

By keeping the blood sugar level stable, you significantly reduce your risk of these complications.

How can I measure blood sugar levels?

You can learn to measure blood sugar levels simply and quickly with a home blood glucose level testing kit. All kits have at least two things: a measuring device and a strip.

To check your blood sugar level, put a small amount of blood on the strip. Now place the strip into the device. After about 30 seconds it will display the blood glucose level.

The best way to take a blood sample is by pricking your finger with a sharp lancet that's designed to penetrate the skin only as far as needed to draw a drop of blood.

What should glucose levels be?

The ideal values are:

- 4 to 7mmol/l before meals
- less than 10mmol/l 90 minutes after a meal
- around 8mmol/l at bedtime.

How often should blood glucose levels be measured?

It depends on your lifestyle - the needs of someone with diabetes who's also a PE instructor are quite different to someone who sits at a computer all day.

If you use insulin

In broad terms, people who have Type 1 diabetes should measure their blood sugar levels daily before meals. Some days one or two tests can be done, while on others four or five might be needed.

Measuring blood sugar levels in the morning before any food gives an indication of the amount of insulin needed overnight.

If you have Type 2 diabetes that's being treated with insulin, you should also follow this schedule.

If you take oral treatments

If your diabetes is treated with tablets or a special diet (Type 2), you should measure your blood glucose levels once or twice a week - either before meals or 90 minutes after a meal.

You should also do a 24-hour profile once or twice a month. This means measuring glucose levels before each meal.

Not everyone with Type 2 diabetes needs to carry out regular blood glucose checks.

For elderly people and those with other medical problems, it's often enough to check the urine for glucose - usually before breakfast and the evening meal.

This is because while good control of diabetes is important, cardiovascular complications (heart attacks, stroke, angina) are the main cause of serious illness and death in people with this type of diabetes.

So people with Type 2 diabetes will benefit from tackling the factors that contribute to their cardiovascular risk by:

- controlling blood pressure more rigorously
- lowering cholesterol levels with medication
- increasing or starting exercise
- stopping smoking.

Blood glucose levels at bedtime

The blood sugar level at bedtime should be between 7 and 10 mmol/l.

If blood glucose is very low or very high at bedtime, you may need to adjust your food intake or insulin dose. Make sure you discuss this with your doctor.

At what other times should blood glucose levels be measured?

Blood glucose should be measured any time you feel unwell or think your blood sugar level is too high or low.

If you have Type 1 diabetes and have more than 20mmol/l of glucose in your blood, you should use a urine strip to check for the presence of ketones.

One of the blood glucose meters available also allows you to check your blood for ketones.

If ketone bodies are present in your urine or blood, it's a warning sign of diabetic acidosis. If this is the case, you should consult your doctor immediately.

How is the blood sugar level checked over a period of time?

A test known as the HbA1c test can show the average blood sugar level over the previous six to eight weeks.

The test looks at levels of HbA1c in a sample of blood.

HbA1c is the compound produced by the chemical reaction between haemoglobin and glucose in the blood. HbA1c is also called glycated haemoglobin.

High blood sugar levels produce more HbA1c. But because the process happens over several weeks, an occasional blip of high blood sugar is not enough to influence the HbA1c level.

This means only consistently high glucose levels cause HbA1c levels to rise - and why HbA1c levels are used as a measure of diabetes control.

- HbA1c is about 6 per cent of the total haemoglobin in people who don't have diabetes. The target to aim for is an HbA1c level of below 6.5 per cent if possible – although 7 per cent or less is very good.
- HbA1c of 7.5 per cent shows only fair control of diabetes.
- HbA1c above 8.5 per cent shows poor control of diabetes.

Any increase in the HbA1c level indicates poorer control of diabetes.

The United Kingdom Prospective Diabetes Study Group (UKPDS) was a 20-year-long research trial in diabetes.

It showed that for every 1 per cent rise in HbA1c, a person with Type 2 diabetes is 30 per cent more likely to develop late-stage complications arising from damage to the small blood vessels.

In Type 1 diabetes, the same relationship between high HbA1c and increased development of complications was shown by the Diabetes Control and Complications Trial in the US.

What is an ECG?

ECG (electrocardiogram) is a test that measures the electrical activity of the heart. The heart is a muscular organ that beats in rhythm to pump the blood through the body.

The signals that make the heart's muscle fibres contract come from the sinoatrial node, which is the natural pacemaker of the heart.

In an ECG test, the electrical impulses made while the heart is beating are recorded and usually shown on a piece of paper. This is known as an electrocardiogram, and records any problems with the heart's rhythm, and the conduction of the heart beat through the heart which may be affected by underlying heart disease.

What is the resting ECG used for?

The information obtained from an electrocardiogram can be used to discover different types of heart disease. It may be useful for seeing how well the patient is responding to treatment.

- It is a good idea to have an ECG in the case of symptoms such as dyspnoea (difficulty in breathing), chest pain (angina), fainting, palpitations or when someone can feel that their own heart beat is abnormal.
- The test can show evidence of disease in the coronary arteries. Unfortunately, in many people who have significant narrowing of the arteries supplying the heart muscle, the ECG recording made at rest is often normal. Therefore, if a significant narrowing is suspected, an ECG recording is often made when the patient is exercising (an exercise stress test) as this is more likely to reveal the problem.
- An ECG can be used to assess if the patient has had a heart attack or evidence of a previous heart attack.
- An ECG can be used to monitor the effect of medicines used for coronary artery disease.
- An ECG reveals rhythm problems such as the cause of a slow or fast heart beat.
- To demonstrate thickening of a heart muscle (left ventricular hypertrophy), for example due to long-standing high blood pressure.
- To see if there are too few minerals in the blood.

An ECG may appear normal even in the presence of significant heart disease. Thus, for a full assessment of the heart, other tests may be needed.

How is an ECG performed?

It depends on what is being measured. Usually, an ECG is taken while the patient is resting, but if there is concern that a patient's symptoms may be caused by coronary artery disease the test is done while the patient is on an exercise bike or treadmill.

It may also be used to assess the success of drug treatment or coronary revascularisation

such as coronary intervention or bypass surgery.

It may be necessary to supplement an ECG with additional tests, such as a radioisotope perfusion scan, which uses low-dosage radioactive dye to show which areas of the heart muscle receive the best and worst blood supply, or angiography (X-ray examination of arteries), to determine the extent of the illness and the cause of symptoms.

How is an ECG performed?

- Up to 12 self-adhesive electrodes will be attached to select locations of the skin on the arms, legs and chest. Areas such as the chest where the electrodes will be placed may need to be shaved. First, the skin is cleaned. The test is completely painless and takes less than a minute to perform once the leads are in position. After the test, the electrodes are removed.
- The doctor will review the paper print-out of the ECG.

Is an ECG dangerous?

- When the patient is at rest it is completely harmless.
- If an exercise test is performed, the patient may get chest pains that will resolve after the exercise is stopped. This examination must be supervised by a medical doctor in addition to the ECG technicians. If necessary, the test will be discontinued at an appropriate time such as in the case of significant chest pain, changes on the ECG, a drop in blood pressure or simply when the patient achieves their target heart rate.

### **Treadmill Test (Stress Test)**

An ECG treadmill stress test should achieve 100% of predicted maximal heart rate unless medically contraindicated or prevented either by symptoms or medications. Studies of less than 85% of maximum predicted heart rate and less than 8 minutes of exercise (6 minutes for age 70 or greater) may serve a basis for denial. Beta blockers and calcium channel blockers (spec. diltiazem and verapamil), or digitalis preparations should be discontinued for 48 hours prior to testing (if not contraindicated) in order to obtain maximum heart rate and only with consent of the treating physician.

The worksheet with blood pressure/pulse recordings at various stages, interpretive report, and actual ECG tracings must be submitted. Tracings must include a rhythm strip, a full 12-lead ECG recorded at rest (supine and standing) and during hyperventilation while standing, one or more times during each stage of exercise, at the end of each stage, at peak exercise, and every minute during recovery for at least 5 minutes or until the tracings return to baseline level. Computer generated, sample-cycle ECG tracings are **unacceptable** in lieu of the standard tracings. If submitted alone, it may result in

deferment until this requirement is met.

In patients with bundle branch blocks, LVH, or diffuse ST/T wave changes at rest, it will be necessary to provide a stress echo or nuclear perfusion study

### **Reasons for Unfitness:**

- The applicant is unable to make at least 85% of maximal heart rate on stress testing or less than 8 minutes (6 minutes if age 70 or greater);
- The applicant develops 1 mm or greater ST segment depression at any time during stress testing. Unless the applicant has additional medical evidence such as a nuclear imaging study or a stress echocardiogram showing the absence of reversible ischemia or wall motion abnormalities reviewed and reported by a qualified cardiologist;
- The nuclear stress testing shows evidence of reversible ischemia, a stress echocardiogram shows exercised induced wall motion abnormalities, or either study demonstrates a negative change from the prior study of the same type;
- The ejection fraction on a nuclear stress test or stress echocardiogram is 40% or less; or a 10% decrease from a prior study; or
- The applicant reports any other disqualifying medical condition or undergoes therapy not previously reported.

### **Echocardiography**

The echocardiogram is an ultrasound of the heart. Thousands of pilots have had this test as part of the recertification process. Using standard ultrasound techniques, two-dimensional slices of the heart can be imaged. The latest ultrasound systems employ 3D real-time imaging.

In addition to creating two-dimensional pictures of the cardiovascular system, the echocardiogram can also produce accurate assessment of the velocity of blood and cardiac tissue at any arbitrary point using Pulsed or Continuous wave Doppler ultrasound. This allows assessment of cardiac valve areas and function, any abnormal communications between the left and right side of the heart, any leaking of blood through the valves (valvular regurgitation), and calculation of the cardiac output as well as the ejection fraction.

Echocardiography is usually performed by cardiologists or cardiac sonographers. Your AME may be experienced in performing and interpreting this test, you he / she may refer you to a cardiologist or other specialist. Regardless of where you get the test, the results will be routed back to your AME and forwarded to the FAA.

### **Types of Echocardiograms**

## **Transthoracic Echo (TTE)**

The standard echocardiogram required by the FAA is also known as a transthoracic echocardiogram, or TTE. In this case, the echocardiography transducer (or probe) is placed on the chest wall (or thorax) of the subject, and images are taken through the chest wall. This is a non-invasive, highly accurate and quick assessment of the overall health of the heart. A cardiologist can quickly assess a patient's heart valves and degree of heart muscle contraction (an indicator of the ejection fraction).

The TTE is commonly used to help diagnose endocarditis. Diagnostic findings by the Echocardiogram include definitive evidence of vegetation or thrombus on valves or other endocardiac structures, abscesses, or disruption of a prosthetic heart valve.

The TTE is highly accurate for identifying vegetations, but the accuracy can be reduced in up to 20% of adults because of obesity, chronic obstructive pulmonary disease, or chest-wall deformities. Transesophageal echocardiography, if available, may be more accurate than TTE because it excludes the variables previously mentioned and allows closer visualization of common sites for vegetations and other abnormalities. Transesophageal echocardiography also affords better visualization of prosthetic heart valves.

## **TransEsophageal Echo (TEE)**

Another way to perform an echocardiogram is to insert a specialised scope containing an echocardiography transducer (TEE probe) into the patient's esophagus, and record pictures from there. This is known as a transesophageal echocardiogram, or TEE. The advantages of TEE over TTE are usually clearer images. The transducer is closer to the heart and doesn't have the ribs and lungs to deflect the ultrasound beam. Some structures are better imaged with the TEE. These structures include the aorta, the pulmonary artery, the valves of the heart, and the left and right atria. While TTE can be performed easily and without pain for the patient, TEE may require light sedation and a local anesthetic lubricant for the esophagus. Unlike the TTE, the TEE is considered an invasive procedure. In some situations, the FAA may require that the airman undergo a TEE instead of a TTE. Work closely with your AME so you know what to expect and avoid unnecessary testing.

In some centers, sedation is used to ease the discomfort to the individual. The use of local anesthetic agents and sedation can decrease the gag reflex, making the ultrasound probe easier to pass into the esophagus. The transducer and cable are then coated in a lubricant, placed in the patient's mouth, and then passed down the patient's throat. The patient is instructed to swallow while the probe is being passed down, to prevent it from going into the trachea. Although the placement of the thumb-wide transducer is uncomfortable,

there are very few complaints of gagging from the patient once the transducer is in the correct location.

### Stress Echo

Finally, some of the FAA protocols refer to a "stress echo," which is a specialized form of echocardiogram with greater sensitivity for coronary heart disease. During this test, the pilot has an echocardiogram is done both before and after the heart is stressed either through exercise or by injecting a medicine that makes your heart beat harder and faster. A stress echocardiogram is usually done to find out if you might have decreased blood flow to your heart. Be sure to clarify with your AME which type of Echocardiogram you will need.

Echocardiogram	
<b>Normal:</b>	The heart chambers and walls of the heart are of normal size and thickness, and they move normally.
	Heart valves are working normally, with no leaks or narrowing. There is no sign of infection.
	The amount of blood pumped from the left ventricle with each heartbeat (ejection fraction) is more than 55%.
	There is no excess fluid in the sac surrounding the heart, and the lining around the heart is not thickened.
	There are no tumors and blood clots in the heart chambers.
<b>Abnormal:</b>	Heart chambers are too big. The walls of the heart are thicker or thinner than normal. A thin heart wall may mean poor blood flow to the heart muscle or an old heart attack. A thin, bulging area of the heart wall may indicate a bulge in the ventricle (ventricular aneurysm). The heart muscle walls do not move normally because of a decreased blood supply from narrowed coronary arteries.
	One or more heart valves do not open or close properly (are leaking) or do not look normal. Signs of infection are present.
	The amount of blood pumped from the left ventricle with each heartbeat (ejection fraction) is less than 55%.
	There is fluid around the heart (pericardial effusion). The lining around the heart is too thick.
	A tumor or blood clot may be found in the heart.

## Angiography

What is angiography?

Angiography is a test that uses an injection of a liquid dye to make the arteries easily visible on X-rays.

When is angiography used?

An angiogram was once commonly used to check the condition of blood vessels. Nowadays, non-invasive tests provide the same information with less discomfort and risk to the patient. These include: Doppler, digital subtraction angiography (from venous dye injection), ultrasound, CT scans and MRI scans.

- Angiography may be used if the doctor is considering surgery, because it shows a clear picture of the blood vessels.
- Angiography may reveal aneurysms (a bulge on an artery caused by a blood vessel wall becoming weaker).
- An angiogram can also be used to give a good view of the carotid artery and its branches in the neck and head. This is generally done to investigate a bleed in the brain (cerebral bleed) or identify the blood supply to a tumour. The angiogram can be used to show if an operation is necessary or possible.
- Angiography is used to look at the coronary arteries that send blood to the heart. The test is used to show if the arteries of the heart have narrowed.
- Angiography is used to look at the arteries in the legs and kidneys, as well as the aorta (the body's largest artery).
- Angiography is used to look at the liver to localise abnormalities, including tumours. This can be particularly useful when planning surgery.

How is angiography done?

Before taking an X-ray, a liquid dye is injected into the blood vessels. When the test is on the arteries of the heart, the carotid artery, or the major arteries coming from the aorta, the catheter is inserted into the groin, or occasionally the arm.

- Before a catheter can be inserted into an artery, the surrounding area has to be numbed with a local anaesthetic.

- A short, thin wire with a rounded tip is then carefully inserted into the artery using a needle. It is guided with the help of fluoroscopy (X-ray images) to the spot where the dye is needed.
- The needle is then removed and a vascular sheath inserted around the wire. A catheter may then be inserted along the guide wire.
- When the catheter is in the correct position, the wire is pulled out and dye is inserted through the catheter. The patient may experience a feeling of warmth in the area, but this will disappear after a few seconds.
- Now the blood vessels can be checked on a screen, or on a series of rapidly recorded X-rays.

Is angiography dangerous?

- A small minority of patients are allergic to the liquid dye, mainly due to the iodine content of the dye. Anyone who has previously experienced such reactions should mention this to the doctor.
- There is a small risk of the catheter damaging the blood vessels that it was inserted through.
- Cerebral angiography carries a small but significant risk of a serious adverse outcome.
- Pregnant women should enquire about the risks of the fluoroscopy (X-ray screening) harming their baby.
- Patients suffering from severe liver, heart or kidney diseases may be at greater risk, and should seek advice from the specialist.
- The risk of X-rays being harmful is very small. Modern X-ray machines are designed to take high quality pictures using the minimum radiation dose.

